



Organic food conversion in Danish public kitchens

The effects of the Danish Organic Action Plan 2020 on organic public procurement and wellbeing at work

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on organic public procurement and wellbeing at work



Nina Nørgaard Sørensen
PhD Thesis
April 2016

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By

Nina Nørgaard Sørensen

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Organic food conversion in Danish public kitchens

- The effects of the Danish Organic Action Plan 2020 on organic public procurement and wellbeing at work

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Preface

In 2012, the Ministry of Environment and Food of Denmark (the former Danish Ministry of Food, Agriculture and Fisheries) launched the Organic Action Plan 2020. The primary aim was to increase organic public procurement in Denmark in order to increase the demand for organic food products, and thereby stimulate a growth in organic agricultural land in Denmark. Consequently, 10 organic food conversion projects received funding during fall 2012 and spring 2013 to educate public kitchen workers in increasing organic procurement within their existing budget.

This PhD study presents the results of the effectiveness of the funded organic food conversion projects in increasing the organic food percentage in participating public kitchens and on the experienced wellbeing among kitchen workers. This research was conducted at the Division of Diet, Disease Prevention and Toxicology (former Division of Nutrition), the National Food Institute, Technical University of Denmark between November 2012 and November 2015. This work was supported financially by the National Food Institute, Technical University of Denmark and the Technical University of Denmark.

Organic food conversion has been implemented in public kitchens in Denmark for years, yet this is the first time specific measurements of the organic food percentage have been documented scientifically. This PhD thesis also contributes with new knowledge regarding experienced wellbeing among kitchen workers, which is important in terms of assessing the likelihood of increasing organic public procurement in the long-term. Evaluations of organic food conversion projects such as this PhD thesis are necessary to guide decision-making in relation to prioritising organic food conversion in public kitchens. It is my hope that the results presented here will inspire future research in this area as well as the initiation of further programmes promoting organic public procurement.

Nina Nørgaard Sørensen, April 2016

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Abbreviations

CAP	Common Agricultural Policy
COPSOQ	Copenhagen Psychosocial Questionnaire
EC	European Commission
EFSA	European Food Safety Authority
EU	European Union
IARC	International Agency for Research on Cancer
IFOAM	International Federation of Organic Agriculture Movements
iPOPY	The Study of Innovative Public Organic Food Procurement for Youth
IQR	Interquartile range
MDG(s)	Millennium Development Goal(s)
NNR	Nordic Nutrition Recommendations
NRCWE	National Research Centre for the Working Environment
RCT	Randomised-controlled trial
SDG(s)	Sustainable Development Goal(s)
WHO	World Health Organization

List of papers

The present PhD thesis is based on the three papers (Paper I-III) listed below referred to by their roman numerals from here on:

- I) The Danish Organic Action Plan 2020: assessment method and baseline status of organic procurement in public kitchens.
Sørensen NN, Lassen AD, Løje H & Tetens I.
Public Health Nutrition 2015, 18(13): 2350-7.
- II) Effectiveness of the Danish Organic Action Plan 2020 in increasing the level of organic public procurement in Danish public kitchens
Sørensen NN, Tetens I, Løje H & Lassen AD
Resubmission due May 8th 2016
- III) Wellbeing at work among kitchen workers during organic food conversion in Danish public kitchens: a longitudinal survey
Sørensen NN, Løje H, Tetens I, Wu JHY, Neal B & Lassen AD.
European Journal of Public Health 2015, 1-6 (E-pub ahead of print).

Reprinted versions of the two papers and the manuscript are enclosed in appendices.

Summary

Organic agriculture has been recognised for its protective effects on environment, climate, water, soil and terrestrial and aquatic wildlife. Improved human health from organic food consumption has also been highlighted, resulting from limited dietary exposure of pesticide and fertiliser residues. One political initiative developed to promote organic food production is the Danish Organic Action Plan 2020 initially launched in 2012, updated in 2015, in which funding for the implementation of organic food conversion projects in public kitchens has been made available to increase organic public procurement. Through educational strategies targeted kitchen workers, organic food conversion projects aim to increase the organic food percentage in the public kitchens within the existing budget.

The overall aim of this PhD study was to contribute to the scientific evidence base on the effectiveness of organic food conversion in public kitchens. The objectives were to compare organic food percentage measurements by the Organic Cuisine Label method and the Dogme method in public kitchens (Paper I), to measure the effect of organic food conversion projects in the Danish Organic Action Plan 2020 on the organic food percentage in participating public kitchens (Paper I and II) and finally, to measure the effect of organic food conversion projects on the experienced wellbeing among kitchen workers (Paper III).

Organic food percentage measurements by the Organic Cuisine Label method (based on procurement invoices) and the Dogme method (based on self-reported procurement) were compared in a sample of 26 public kitchens and baseline organic food procurement status of the Danish Organic Action Plan 2020 was collected. A significant correlation coefficient was found between the two organic food procurement measurement methods ($r=0.83$, $p<0.001$) with measurements relevant for the baseline status. The baseline status was based on organic food procurement measurements from 345 public kitchens participating in the six organic food conversion projects initiated during 2012 and 2013 and was found to be 24% in a weighted average across the eight different kitchen types when including measurements from both the Organic Cuisine Label method and the Dogme method.

The effect of organic food conversion projects on the organic food percentages was measured in all public kitchens ($n=622$) completing one of the nine organic food conversion projects under the Danish Organic Action Plan 2020 during fall 2012 and spring 2013. Furthermore, the curriculum components of the nine conversion projects were mapped to explore differences in educational approach. The organic food percentage increased significantly from a median (IQR) of 38% (6-66) at baseline to 69% (48-83) at follow-up ($p<0.001$) during a median follow-up

period of 1.5 years. The proportion of public kitchens eligible for either the Organic Cuisine Label in silver (60-90% organic food procurement) or gold (90-100% organic food procurement) labels doubled from 31% to 62%. Conversion project curriculum mostly included elements of “Theory”, “Menu-planning”, “Network” and “Organic Cuisine Label method” to ensure successful implementation.

Experienced physical and psychological wellbeing at work along with beliefs and attitudes among kitchen workers was measured before (n=235) and after (n=149) participating in educational training programmes in organic food conversion through an online self-administered questionnaire with one year follow-up. Results from an unpaired, 2-sided t-test showed no significant differences between baseline and follow-up measurements of organic food conversion on psychological wellbeing at work and only one significant difference was observed among the six parameters measuring physical wellbeing in relation to general body fatigue. Kitchen workers reported improvements in motivation to work with organic food production ($p=0.012$) and increased perceived food quality ($p<0.001$) as well as application of nutritional guidelines ($p<0.001$).

Curriculum components identified in the conversion projects included food-waste reduction, focus on plant-based menus, local and seasonal procurement and nutritional guideline application as contributing factors to increased organic procurement. Additional beneficial effects on sustainability and dietary guideline compliance in the public procurement may therefore also be relevant during conversion, which could have potential implications for political initiatives at national and international level.

In conclusion, the present PhD thesis presents valuable results in terms of a significant increase in organic public procurement following the implementation of organic food conversion projects. This increase was achieved without observing effects on psychological wellbeing at work among the kitchen workers and only significant effects on one out of six parameters on physical wellbeing. Further, kitchen workers reported positive effects to the perceived food quality, motivation to work and application of nutritional guidelines.

The present PhD project shows that implementing organic food conversion projects in public kitchens is an effective strategy to increase organic public procurement in Denmark without harmful effects to kitchen worker wellbeing in the short term. Future research in this area should explore effects on nutrition and health as well as effects in the long-term following organic food conversion in public kitchens.

Summary (Danish)

Økologisk landbrug er blevet anerkendt for at have beskyttende effekter på miljø, klima, grundvand, jordbund samt det terrestriske og akvatiske dyreliv. Forbedret sundhed via en økologisk kost har været fremhævet som et resultat af mindsket eksponering af pesticid og gødningsrester. Ét af de politiske tiltag udformet for at fremhæve økologisk madproduktion er Økologiplan Danmark lanceret først i 2012 og opdateret i 2015, hvor midler har været afsat som del af tiltaget til implementeringen af økologioplægningsprojekter i offentlige køkkener for at hæve økologiprocenten. Ved brug af undervisningsstrategier målrettet køkkenpersonalet, har formålet med økologioplægnings-projekterne været at hæve køkkenets økologiprocent inden for det eksisterende budget.

Det overordnede formål med dette ph.d. projekt har været at bidrage med viden om effekten af økologioplægningsprojekter i offentlige køkkener. De specifikke formål har været at sammenligne målinger af økologiprocenten ved Spisemærkemethoden og Dogmemetoden i offentlige køkkener (Artikel I) for at kunne måle effekten af økologioplægnings-projekter under Økologiplan Danmark på økologiprocenten i de deltagende offentlige køkkener (Artikel I og II) og til sidst, at måle effekten af økologioplægningsprojekter på medarbejdertrivslen blandt køkkenmedarbejderne (Artikel III).

Økologiprocenter målt ved Spisemærkemethoden (baseret på fakturaer) og Dogmemetoden (baseret på skøn) blev sammenlignet i 26 udvalgte køkkener og førmålinger for Økologiplan Danmark blev indsamlet. En signifikant korrelations koefficient blev observeret mellem økologiprocentmålinger af de to metoder ($r=0.83$, $p<0.001$) med målinger der gør sig gældende ved førmålingen. Overblikket over førmålingerne af økologiprocenten inkluderede målinger fra 345 offentlige køkkener som deltog i seks økologioplægningsprojekter som blev igangsat mellem 2012 og 2013. Det vægtede gennemsnit af økologiprocenten over de otte forskellige køkkentyper blev målt til 24% når målinger målt ved både Spisemærkemethoden og Dogmemetoden blev taget i betragtning.

Effekten af økologioplægningsprojekter på økologiprocenten blev målt i alle deltagende offentlige køkkener ($n=622$) der gennemførte et af de ni økologioplægningsprojekter under Økologiplan Danmark som blev igangsat mellem 2012 og 2013. Derudover blev undervisningskomponenterne i de ni økologioplægningsprojekter kortlagt for at udforske forskelle mellem projekternes undervisningstilgang. Økologiprocenten steg gennemsnitligt (median) fra 38% (6-66) ved startmålingen til 69% (48-83) ved slutmålingen ($p<0.001$) over en opfølgingsperiode på gennemsnitlig (median) 1.5 år. Andelen af køkkener der kunne komme i

betragtning til et Spisemærke i sølv (60-90%) eller guld (90-100%) fordoblet fra 31% til 62% ved slutmålingen. Økologiømlægnings-projekterne inkluderede oftest komponenter som "Teori", "Menuplanlægning", "Netværk" og "Spisemærkemethoden" i undervisningen for at sikre en succesfuld ømlægning.

Psykologisk og fysisk arbejdsstrivsel samt overbevisninger og holdninger blandt køkkenmedarbejdere blev målt før ($n=235$) og efter ($n=149$) deltagelse i et økologiømlægningsprojekt gennem et online selvadministreret spørgeskema med et års opfølgning. Resultater fra en uparret, 2-siddet t-test viste ingen signifikante forskelle mellem før og eftermålinger af den psykiske arbejdsstrivsel og kun en enkelt signifikant forskel blev observeret ud af de seks parametre der målte fysisk arbejdsstrivsel i forbindelse med generel træthed i kroppen. Derimod udtrykte køkkenmedarbejderne at de følte sig mere motiverede til at arbejde med økologisk madproduktion ($p=0.012$) samt at madkvaliteten ($p<0.001$) og brugen af ernæringsmæssige retningslinjer ($p<0.001$) var forbedret.

De identificerede undervisningskomponenter i ømlægningsprojekterne inkluderede reduktion af madspild, fokus på plante-baseret kost, lokal og sæson orienteret forplejning samt brug af ernæringsmæssige retningslinjer som medvirkende faktorer til en øget økologisk forplejning. Øvrige gavnlige effekter på bæredygtighed og overholdelse af kostanbefalinger er derfor muligvis også relevante under en ømlægning, og disse kunne medføre potentielle implikationer for den politiske udvikling på nationalt og internationalt niveau.

Det konkluderes at nærværende ph.d. afhandling giver vigtige resultater i forhold til effekten af økologiømlægningsprojekter i offentlige køkkener. Resultaterne indikerer et betydeligt løft i den økologiske offentlige forplejning som følge af implementeringen af økologiømlægningsprojekter og at dette løft blev observeret uden ændringer i psykisk arbejdsstrivsel for medarbejderne og kun en enkelt signifikant forskel ud af seks for fysisk arbejdsstrivsel. Derudover angav køkkenmedarbejderne en positiv effekt på madkvaliteten, motivation for arbejdet samt anvendelse af ernæringsmæssige retningslinjer.

Nærværende ph.d. projekt viser at implementeringen af økologiømlægnings-projekter i offentlige køkkener er en effektiv strategi for at øge økologien i den offentlige forplejning i Danmark uden skadelige virkninger på medarbejdernes arbejdsstrivsel på den korte bane. Fremtidig forskning indenfor dette område bør undersøge effekter på ernæring og sundhed samt langvarige effekter af økologiømlægning i offentlige køkkener.

1. Background

1.1 Development and effects of organic agriculture

1.1.1 Development of organic agriculture

Organic agriculture has changed and developed over a long period of time. Following the first mass-production of artificial fertilisers during World War I using the Haber-Bosch process^(1,2), biologists initiated conceptualisations of biodynamic farming such as Rudolf Steiner who is said to have developed the first lectures on organic farming⁽³⁾. From biodynamic farming came organic farming and among the first to put theory into practice was Jerome Rodale during the 1940s⁽⁴⁾. Food shortages during and following World War II increased European focus on intensive livestock production rather than organic agriculture, resulting in the establishment of the Common Market and the Common Agricultural Policy (CAP) which would turn out to be difficult to reform⁽⁵⁾.

The world's first organic farming advocacy association was The Australian Organic Farming and Gardening Society founded in Australia in 1944, and they were also behind the formulation of the first set principles of organic farming^(6,7). The formation of the International Federation of Organic Agriculture Movements in 1972 in Versailles (named IFOAM Organics International in 2015) marked an important step in terms of acknowledging and safeguarding organic farming definitions, standards, accreditations and certifications and since, IFOAM Organics International has grown to represent 117 countries and become a leading umbrella organisation^(8,9).

Globally, 172 countries have organic agriculture activity, organic agricultural land has grown to cover 43.7 million hectares and has taken up a market size of 80 billion USD⁽¹⁰⁾. As the food systems promoted by CAP along with growing populations and consumption needs are not considered sustainable, actions have been called for to transform the food production system globally in order to prevent and mitigate the deteriorating environments, climate changes and public health issues currently unfolding^(11–13). In light of this development, organic agriculture has become increasingly more acknowledged for potentially providing public goods related to the environment, economic development and social wellbeing^(10,14,15).

1.1.2 Effects to environment and sustainability of organic production

Strong links between organic agriculture and the environment have been described since the 1940s. This was established with the definition of organic agriculture by IFOAM from 2008, through which organic agriculture, environment and sustainability have become borderline inseparable: “Organic Agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved”⁽¹⁶⁾

Organic agriculture is an increasingly important topic in international discussions considering the growing environmental and sustainability challenges^(11,17,18), in which food production has been identified as the main impacting factor^(19–22). Organic food production systems have been recognised for more protective effects on environment and climate compared to conventional systems^(16,23). This is not only in relation to pesticide and fertilizer use^(24,25) but also regarding climate change mitigation, water and soil quality, protection of wildlife and biodiversity and environmental stress resilience^(26–32).

A recently published review of the past 40 years research comparing organic and conventional agricultural systems in terms of sustainability suggests that the environmental advantages of organic agriculture outweigh potential lower yields and also that currently, adequate kilocalories are being produced to feed the global population but rather adequate food access is lacking⁽¹⁴⁾. These findings are supported by a Danish review, concluding that organic agriculture overall contributes with public goods that are not reflected in the produce price level and further, that organic agriculture is a valuable tool to implement beneficial synergies between these areas using only one method⁽¹⁵⁾.

However, in terms of national impact it should be noted that pesticide application has been on the political agenda in Denmark since the 1990s^(33,34), which has resulted in a limited pesticide application frequency and load in Denmark⁽³⁵⁾. The Danish national pesticide residue control for 2014 concluded that pesticide residue levels in food were lowest among Danish conventional food products compared to conventional products within the EU and from third countries^(36,37). It could therefore be argued that even if increased organic agriculture in Denmark might lower pesticide pollution further, the difference in terms of sustainability and pesticide pollution would not be as significant in Denmark as in other countries in the EU and globally.

1.1.3 Organic food and human health effects

Besides environmental concerns, another key driver for the organic food products market is consumers' health concerns. Appropriate nutrition plays a key role in human health regarding overall energy intake, distribution of macronutrients (proteins, fats and carbohydrates) as well as sufficient micronutrient intake of vitamins and minerals according to the body's needs^(38,39). Determinants of health include social, economic and physical environment along with individual characteristics and behaviours according to the World Health Organization (WHO), who define health as: "[...] a state of complete physical, social and mental well-being, and not merely the absence of disease or infirmity"^(40,41).

Considering the human health effects of organic foods compared to conventional foods, three overall areas are relevant to discuss: 1) nutritional composition of foods, 2) harmful constituents of foods, and 3) effects of dietary patterns and whole foods rather than single components.

Nutrient composition in organic and conventional foods

Nutrient composition of food products can be influenced by several factors introduced before, during and after production, which includes air, water, soil, climate and weather conditions, biotic factors such as cultivar choice, bacterial and fungal contamination along with pest damage and control⁽⁴²⁾. Following production nutrient composition may further be affected by harvest methods, storage, transportation and processing⁽⁴³⁾ and therefore nutrient and food content can vary greatly independently of whether the food products have been produced organically or conventionally. Systematic reviews on the nutritional content of organic foods compared to conventional did not find significant differences between the two agricultural systems^(44–48).

The first systematic review on the topic covered publications over the past 50 years and included 24 field trials, 27 farm surveys and four basket surveys⁽⁴⁵⁾. The review concluded that there were only minor differences in the nutritional content between certain organic and conventionally produced foods which were not likely to be of public health relevance and further highlighted the heterogeneity of the research in the area, being too limited and of too poor quality for a meta-analysis⁽⁴⁵⁾.

Another review and meta-analysis by Barański M. et al.⁽⁴⁹⁾ (2014) including 343 peer-reviewed publications (156 field trials, 116 farm surveys and 55 basket surveys) found significantly higher levels of carotenoids, xanthophylls and vitamin C in organic crops compared to conventional⁽⁴⁹⁾, which is in agreement with other reviews^(50–52). Baranski M. et al. obtains a significantly larger evidence base compared to Dangour A. et al. by including all literature until 2011 and comparative field experiments⁽⁴⁹⁾.

Regarding mineral content, significant compositional differences in iron and magnesium between organic and conventionally produced foods have been found^(49,51,52,57). Differences in iron content in plant-based foods may indeed carry less public health relevance compared to differences in secondary metabolites and vitamins due to the restricted bioavailability of the plant food source^(49,51). Two meta-analyses comparing organic and conventional dairy milk products found that organic dairy products contained significantly higher concentrations of protein and of total polyunsaturated fatty acids, omega-3 fatty acids, alpha-linolenic acids, very long-chain omega-3 fatty acids and conjugated linoleic acid compared to conventional products^(56,58). A healthier fatty acid profile in organic meat was found in terms of higher concentrations of polyunsaturated fatty acids and omega-3 acids but the authors emphasised that, heterogeneity was high and further studies are needed⁽⁵⁹⁾.

In summary, there is a large body of literature on potential differences in nutrient composition between organic and conventional foods but with mixed results and substantial methodological shortcomings. The methodology applied in Baranski M. et al. allows for meta-analyses to be performed despite various study designs and reporting of results which were otherwise problems put forward by Dangour a. et al^(49,55,60). It remains uncertain whether the differences found in favour of nutritional composition of organic food carry large scale public health impacts and so further research is required in order to draw conclusions on production system preferences in terms of human health effects.

Potential harmful constituents of organic and conventional foods

Potentially harmful food constituents relevant to this thesis include pesticides, antibiotic-resistant bacteria, mycotoxins and metals. Mycotoxins and metals are not added during food production but occur naturally unlike pesticides and antibiotic regimens, which are prohibited to a great extent by regulation in organic food production compared conventional. Few or no significant differences have been established between organic and conventional agriculture regarding mycotoxins^(52,61), but a meta-analysis found cadmium concentrations to be 48% lower on average in organic produce compared to conventional⁽⁴⁹⁾.

Potential health risks from constituents added during production include antibiotic-resistant bacteria from antibiotic regime application, where a review concluded on a 33% higher risk of antibiotic-resistant bacteria contamination in conventional livestock compared to organic alternatives⁽⁶²⁾. Also pesticides that are primarily applied during conventional food production have been discussed widely in the scientific literature, relating to their chemically reactive structures and potential endocrine-disrupting properties^(63–65). For decades, pesticide exposure has posed a public health concern in terms of agricultural occupational hazards, linking parental occupational pesticide exposure to serious birth defects to infants such as up to 36% increased

risk of hypospadias^(66–69). This has recently been associated with long-term impaired reproductive function in an eight-year cohort study⁽⁷⁰⁾ and childhood leukaemia and Parkinson's disease during a systematic review and meta-analysis covering literature from 2006 to 2012⁽⁷¹⁾.

Dietary pesticide exposure has gained more attention recently^(72–74). Two systematic reviews reported a significant increased risk of contamination of pesticide residues in conventionally produced foods compared to organic foods^(49,62). Adverse health consequences from dietary pesticide exposure have been suggested recently based on a five-year cohort from Massachusetts USA (n=155) in terms of lower semen quality⁽⁷⁵⁾. Also two prospective birth cohorts, a Dutch (n=2764) and a Norwegian (n=35.107), have shown a decreased risk of eczema and pre-eclampsia as well as having a boy with hypospadias associated with self-reported organic food consumption^(76–78). These studies include a strong design and large sample sizes but rely primarily on self-reported food consumption which may pose limitations to the dietary intake components.

Regulation on pesticide application in the European Union (EU) is based on extensive risk assessment procedures⁽⁷⁹⁾. EU pesticide residues monitoring programme coordinated by European Food Safety Authority (EFSA) along with the Danish national pesticide residue control concluded that the detected levels were of no significant public health concern^(36,80) and further, that pesticide residue levels in Denmark were lowest among organic agricultural products^(36,37). However, these risk assessments have been criticised for lacking criteria and technical guidelines for suitable testing of endocrine-disruption and cocktail effects between pesticide residues, additive and natural toxins^(15,81–83). Responses to these criticisms are being developed upon but have not yet been implemented⁽⁸⁴⁾.

In summary, several uncertainties remain with regard to the adverse health effects of pesticide residues and other pollutants. Differences in levels of potentially harmful food constituents between organic and conventional food products may be present, mainly due to different production practices, but based on the strength of the scientific evidence it is not possible to quantify the increased risks to public health from consumption of one food product over the other.

Food patterns and dietary quality associated with organic food consumption

Nutrition recommendations to ensure optimal health among the Nordic populations have been updated recently in The Nordic Nutrition Recommendations (NNR) 2012, where the scientific evidence stresses the health impacts from combined food patterns rather than considering single food components in isolation⁽³⁸⁾. The recommendations further conclude that plant-based whole diets would be preferable to diets largely based on animal sources⁽³⁸⁾, which is supported

by a growing body of literature suggesting that future development of national dietary guidelines could integrate ecological and nutritional components^(85–90).

Regarding the potential health effects of organic dietary patterns compared to conventional patterns, the scientific studies available are few and mainly reported in cohort studies. The Nutrinet-Santé is a large French web-based prospective cohort (n=104.000) with a planned follow-up of 10 years. The study found an association between increased plant-based dietary patterns among the consumers claiming to be interested in organic foods as well as a generally healthier lifestyle characterized by an increased level of physical exercise, and lower probability of overweight compared to consumers not interested in organic food⁽⁹¹⁾.

The Norwegian Mother and Child Cohort study also described dietary characteristics associated with frequent consumption of organic food among pregnant women (n=63.808), assessed by a general health and food frequency questionnaire. The results showed positive associations between frequent organic food consumption and a diet high in fiber, folate, beta-carotene and vitamin C, and lower density of sodium compared to participants with no or low organic consumption and thus more in line with public advice for healthy and sustainable diets⁽⁹²⁾.

A Danish study based on purchasing behavior among 1.375 Danish households during 2003-2007 found that households with an increased intake of fruit and vegetables and decreased intake of meat and confectionary were more likely to have higher organic food consumption⁽⁹³⁾. These findings were in line with a questionnaire study from the Danish National Birth Cohort where frequent organic food consumption was associated with significantly higher intakes of vegetables, fibre, n-3 fatty acids and less saturated fat (n=60.773) compared to non-organic food consumption⁽⁹⁴⁾.

In summary, dietary patterns rather than single food items may be relevant to consider in terms of human health effects. The present literature comparing dietary patterns of organic and conventional consumers suggest a tendency of healthier patterns among organic food consumers compared to conventional but these associations remain indicative.

Overall, significant differences in nutrient composition and harmful food constituents in favour of organic food products have been suggested but these are unlikely to affect public health. Results of potentially improved dietary patterns of organic food consumers compared to conventional food consumers have also been suggested and though these results remain indicative, improving public health through healthier whole diet patterns rather than single food components seems to be a convincing approach.

1.2 Policy initiatives to support organic agriculture

1.2.1 International policy initiatives

With a growing global population and rapidly worsening climate change effects⁽⁹⁵⁾, public policies intending to regulate food systems towards sustainable development have been advocated for⁽⁹⁶⁾. Several calls for international policy initiatives to improve sustainability and biodiversity have emphasised the importance of the standard and principles behind organic food production^(11–13,16,97–99). In response, the Sustainable Development Goals (SDGs) replaced the Millennium Development Goals (MDGs) at the United Nations summit in 2014 with the establishment of “Transforming our world: the 2030 Agenda for Sustainable Development”⁽¹²⁾. A reformulation of the CAP was agreed upon in 2013 between the European Commission (EC), the European Parliament and the Council of EU Agriculture Ministers, providing stronger financial incentives and acknowledgement of farmers contributing with public goods such as improved environments and biodiversity, e.g. through organic farming^(100,101).

Following impact assessment analyses and the CAP reform, the EC updated the “Action Plan for the future of Organic Production in the European Union” from 2004 in 2014^(102,103). Changes to the plan included acknowledging the movement within organic farming from representing a niche market of limited producers and consumers to experiencing increasing demand. The aim of the plan was to develop organic farming at national and regional levels by improving the market conditions without undermining the integrity of organic farming, while ensuring high quality standards and controls to meet consumers’ expectations⁽¹⁰³⁾.

Priority domains focused on raising awareness among farmers and improving technical gaps in organic production^(103,104). The implemented measures are thus mainly targeted the organic farmers and producers rather than the consumers. To some extent, these features can be identified in national policy development in Denmark as well but here more focus is placed on the consumer level.

1.2.2 The Danish Organic Action Plan 2020

Organic agriculture has been prioritised to a great extent in Denmark compared to other countries. During 2014, Denmark had the highest organic market share (7.6%) of the total market in a global survey on organic agriculture⁽¹⁰⁾ and both import and export of Danish organic products increased from 2012 to 2013⁽¹⁰⁵⁾. Import increased by 16% up to 1.787 million Danish Kroner and export increased by 31% up to 1.533 million Danish Kroner⁽¹⁰⁵⁾. With consumer support and a market share of organic food products expanding despite the financial crises, this development seems to be continuing^(106,107).

National policy development in Denmark also reflects an ambition regarding organic agriculture in line with EU level initiatives as the Ministry of Environment and Food of Denmark in 2012 launched the national policy initiative, the Danish Organic Action Plan 2020⁽¹⁰⁸⁾ with updates in 2015⁽¹⁰⁹⁾. The intention of the Danish Organic Action Plan 2020 is to double the organic agricultural area in Denmark by 2020 through several strategies. Similar to the plan at EU level, the plan includes investments in research as well as providing advisory and technical support for organic farmers to encourage increased conversion of farmland to organic agriculture. However, the main focus of the Danish initiative is to stimulate the overall demand for organic agricultural products through increased organic public procurement and thereby motivate further conversion of organic agricultural land⁽¹⁰⁹⁾. With approximately 6.000-10.000 public kitchens and institutions in Denmark producing around 800.000 meals per day, the potential can be considered significant⁽¹¹⁰⁾.

Consequently, funding grants administered by the Danish Agri-Fish Agency ministerial body, targeting the initiation of organic food conversion projects in Danish public kitchens forms a considerable part of the Danish Organic Action Plan 2020⁽¹⁰⁹⁾. The aim of organic food conversion projects in Danish public kitchens is to facilitate an educational program, managed by consultants in organic food conversion, with the purpose of training public kitchen workers in the application of organic food products within their existing budget. That is, no funding is available to cover the price premiums associated with implementing organic food production in the public kitchens^(15,111). Rather, funding grants are awarded to successful applications from eligible companies, organisations and educational institutions in which the following required project details are specified: descriptions of the applicant organisation, project collaborators (if any), detailed project content descriptions with budgeting, CVs for each key project manager and contract-agreements between collaborators⁽¹¹²⁾.

Hence, the managing institutions of the funded organic food conversion projects are individually responsible for selecting the participating public kitchens, organising the implementation of the educational approach and measuring the organic food percentage in each public kitchen before and after the implementation of the organic food conversion project. Figure 1.1 presents an overall illustration of the Danish Organic Action Plan 2020 policy area focusing on organic conversion projects in public kitchens.

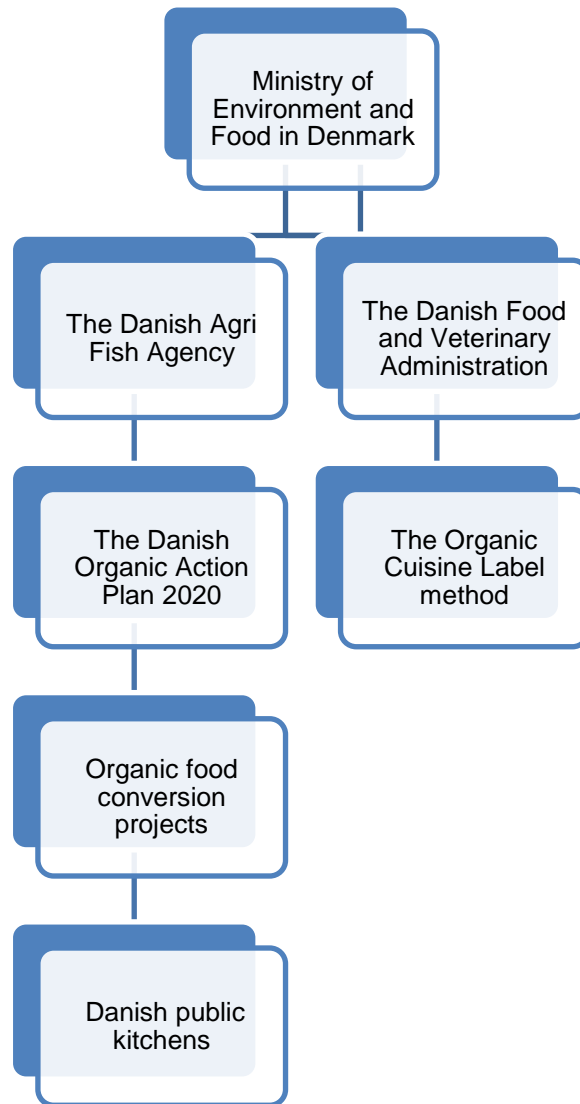


Figure 1.1 Organic food conversion project within the Danish Organic Action Plan 2020

The Danish Veterinary and Food Administration is the second ministerial body involved in the organic food conversion project within Danish Organic Action Plan 2020, playing an important role e.g. in terms of registering the organic food percentage measurements. These measurements are to be documented through the Organic Cuisine Label, a measurement and labelling scheme developed by the Danish Veterinary and Food Administration^(113,114).

1.2.3 The Danish Organic Cuisine Label

In 1987, the Danish government established the first legislation on organic food production control and in 1989 the Danish organic label “red-Ø” was introduced⁽¹¹⁵⁾. This label enabled organic farmers to distinguish themselves and their products from conventionally produced food

products. Since then, focus on organic food market has increased steadily in Denmark⁽¹⁰⁷⁾ and the need for labelling in catering services developed. The Organic Cuisine Label was launched in 2009, representing the official Danish method to measure and label organic food percentages⁽¹¹³⁾.

Public kitchens as well as restaurants are able to apply for the label to the Danish Veterinary and Food Administration to promote and market their commitment to organic food production⁽¹¹⁶⁾ (Figure 1.2). The label application requires kitchen supplier invoices over a three-month period, documenting an organic food percentage level within one of the following three intervals: 30-60% (bronze), 60-90% (silver) and 90-100% (gold), where an organic food percentage between 0-30%, does not qualify for any label⁽¹¹⁷⁾.



Figure 1.2 The Organic Cuisine Labels representing the three intervals

The Organic Cuisine Label has been argued to contribute to improved organic public procurement by introducing a reliable and transparent measurement method, adding motivational elements to the conversion process, increasing official acknowledgement and awareness of the kitchen achievements as well as contributing to high organic food percentage levels being maintained once they have been reached⁽¹¹⁶⁾.

1.3 Organic food conversion in public kitchens

1.3.1 Development of organic public procurement

Starting in the 1980s and 1990s, Danish public procurement generally underwent reforms to optimise food production, introducing centralised food production with increased use of cook-chill food production systems and ready-made food products to reduce headcounts⁽¹¹⁸⁾. An official evaluation of the public procurement in 1994 indicated insufficient food- and nutritional

quality of the public foodservice, a lack of communication among stakeholders along with a lack of prioritisation of the area by authorities⁽¹¹⁸⁾. Organic food conversion developed in response to the call for changes in public procurement in several areas such as increased cooking from base, use of food ingredients of better quality, more nutritious food and improved eating environments^(119–121). These areas could be considered quite diverse and not directly linked to organic food procurement but the organic food conversion process includes most of them⁽¹²⁰⁾.

Since the beginning of the early conversion projects, governmental initiatives on organic food conversion have been presented such as “The Action Plan – Organic Development” in 1995 and “The Green Shopping Scheme” in 1996^(122,123). These initiatives were targeted public kitchens catering for children, elderly and patients and included a maximum level of 50% funding for the initiation of an organic conversion project. Also, the Copenhagen House of Food foundation has with governmental support been working towards the ambitious goal of 90% organic public procurement in the Copenhagen area since 2001, currently with a level at 80%^(124,125). Childcare and elderly care institutions have been the main focus point but canteens and central kitchens have also gained more attention⁽¹²⁵⁾.

Organic public procurement has received attention internationally in the EU research funding bodies^(126–128), for example through The Study of Innovative Public Organic Food Procurement for Youth (iPOPY) 2007-2010, in Denmark, Norway, Finland and Italy^(129–131), which was funded through the FP7 funding programme. The iPOPY project aims to contribute to increased organic food consumption for youth in Europe with a focus on public school meals, mapping the school food systems in the participating countries in terms of stakeholders, challenges and opportunities to learn from⁽¹³¹⁾. However, no project so far has presented specific measurements of change on organic food percentages and therefore these measurements are still called for in order to evaluate the effect of the conversion process found in Denmark in greater detail^(111,123).

1.3.2 Organic food substitution versus conversion

The approach to organic food conversion in public kitchens varies between projects depending on the experience of the project manager and kitchen workers as well as prerequisites of the public kitchens in question. From Danish experiences with successful conversion processes, certain principles of organic food conversion have been formulated, and variations of these are therefore commonly applied in conversion projects today^(15,125).

In organic procurement programs, it is important to distinguish between organic food substitution and conversion. Organic food substitution has been defined as the practice in which kitchens replaces individual conventional food products in their procurement with organic substitutions and this strategy has therefore been described as reversible^(119,132). An example of

such substitution strategy is the Organic Steps from Finland described by Tikkanen I. (2012) involving five steps and only focusing on increasing the number of food items procured in organic versions⁽¹³³⁾. However, organic food products usually carry an extra cost of production compared to conventional food products and so, this strategy will only be possible in cases where food production budgets are not a limiting factor. In Denmark, budgets in public procurement have for long been restricted and quality assurance demanding^(134,135) and so far, no initiative in organic public procurement has added resources intended to cover the additional costs of organic food production.

As a result, the conversion strategy has been developed upon rather than the substitution strategy in order to achieve a higher organic food percentage within the already existing food budget of the public kitchens^(111,125). A similar conversion process has been described in projects on public procurement in Austria, but here additions to the food budget had to be made to increase the organic share above 30%⁽¹³⁶⁾. In comparison, examples from Denmark of 100% organic public procurement with no additions to the budget have been shown to be possible⁽¹²⁵⁾.

The Danish conversion process has been described as a holistic approach in which the entire public kitchen foodservice system is reorganised⁽¹³²⁾. There is no one fixed model of organic food conversion as the conversion process may be initiated based on different backgrounds. However, public kitchen workers have commonly entered a conversion project managed by external conversion consultants with great experience in the field and received training and education according to the needs and ambitions of the individual public kitchen^(125,137).

The educational content of an organic conversion process has been suggested to be based on the following principles^(15,111,119,121,125):

- Produce all meals from base in the kitchen
- Use fresh and raw foods
- Use local and seasonal foods
- Limit meat consumption
- Increase the volume of plant-based foods
- Reduce food waste

Similar principles were suggested following experiences with organic public procurement in Austria in 2003 and to a lower extent also in the USA^(136,138,139). In practice, the conversion process requires that the public kitchen workers rethink their working system and their own role in the kitchen.

Depending on the existing structures and routines in the kitchen and competencies of the workers, the conversion would include^(111,137):

- A thorough mapping of the existing kitchen budget
- Current production system and demands to live up to
- A reformulation of menus to include more vegetables, grains, legumes, lentils and less meat
- Advancement of the cooking-skills of the workers to facilitate food preparation from base of all meals, potentially using less traditional food ingredients
- Education on recipes using local and seasonal foods
- Education on nutritional content of the menus and the nutritional requirements of the kitchen users
- Implementation of food production methods that enable re-use of leftovers and that exploits storage capacities in the kitchen

This process could be considered quite complex and several barriers and challenges have been identified by the early conversion projects⁽¹⁴⁰⁾ that have continued to play a considerable role in the implementation of organic public procurement in Denmark as well as abroad and deserve to be elaborated upon^(141–143). Conversion challenges relate to external food system structures in society and internal food production systems of each individual public kitchen.

1.3.3 External and internal challenges for organic food conversion

The list of challenges in the external and internal food system structure is long and the following provides an overview of the main findings reported in Denmark.

Challenges in external food system structures

Initial experiences with organic food conversion reported barriers in terms of supply and demand market drivers characteristic for an immature market^(119,136), where organic food producers and suppliers were unable to guarantee security of supply for the public kitchens while the demand from the public kitchens has been too unstable for producers and suppliers to scale up production and distribution^(140,144). The limited durability of organic fruit and vegetable as well as food selection constraints due to seasonality have also been problematized by both suppliers and public kitchens⁽¹⁴⁰⁾. Added to this came the experienced additional costs of organic food, their processing level, product range and packaging of the food products available which have all been challenges reported earlier in connection to organic procurement^(121,141,143).

Established national public procurement systems⁽¹⁴²⁾ and centralisation of public procurement contracts that might threaten the livelihood of local small scale organic producers and

suppliers⁽¹⁴⁵⁾ have shown to be important potential barriers. Also, opposing political agendas at national, regional and local level have played and continue to play a major role in the development of organic food conversion^(137,144). Some of the challenges have changed over time and improved upon during the continuous implementation of organic public procurement⁽¹²³⁾.

The experiences gained in Denmark over time in terms of promoting organic food, raising public awareness of the benefits of organic food production methods, increasing public support of organic public procurement and thereby strengthening the demand for organic produce seem to have developed the organic market^(106,146). Increased awareness and motivation to overcome the external barriers can also be illustrated by actions taken to promote organic food such as the counselling initiatives now available for stakeholders on public procurement contracts in an attempt to develop opportunities for more organic public procurement⁽¹⁴⁷⁾, which has been called for earlier⁽¹⁴⁵⁾. However, local suppliers of organic food and procurement contracts have still been found to pose limitations to the conversion process⁽¹⁴⁷⁾.

These external challenges in relation to the food system have also been reported in case studies on organic public procurement and local food supply from Norway and Finland in communities where organic food production and demand may be considered less established^(148,149).

Challenges in internal food production systems

Challenges to organic food conversion experienced internally within each public kitchen arise from kitchen characteristics such as public kitchen type, size, geographical location, user target group, history of structural changes, level of furnished kitchen equipment, employee turnover rates and kitchen management that pose varying degrees of barriers. Experiences from qualitative interviews suggested that small public kitchens, especially childcare institutions, have been less problematic to introduce to organic public procurement compared to hospitals and large-scale elderly care institutions where planning and processing procedures can be more complex⁽¹³²⁾. The larger kitchen size, the larger food volumes are needed along with more advanced processing equipment, which also complicates the conversion process⁽¹³²⁾. Public kitchens located within larger regional areas and close to Copenhagen have been shown to potentially benefit from greater political support at both managerial and regional level⁽¹⁴⁴⁾.

A questionnaire survey from 2000 among 908 public procurement employees from various kitchen types across Denmark suggested that reforms implemented in the public kitchens regarding kitchen optimisations, budget cuts and merging of kitchens had caused employment instability, which could have influenced employee motivation towards implementing organic food conversion^(135,137,144). Public kitchen production systems vary which could have complicated the

conversion process. This could be in relation to the number of meals offered per day, whether the food production has taken place on site or if prepared meals would be delivered, whether kitchen users have paid for the meals and the level of nutritional requirements of the kitchen users for the public kitchens to fulfil⁽¹²¹⁾. For instance, patient procurement in hospitals has included different nutritional guidelines to consider compared recommendations for children and elderly^(150,151). In terms of user satisfaction, elderly public kitchen users have been shown to be harder to satisfy than children and this could also have affected implementation of organic procurement^(121,145,152).

With the long list of challenges, both external and internal, the process involved to ensure a successful organic food conversion in public kitchens has required careful consideration and attention to details that may vary depending on the situation of each public kitchen.

1.3.4 Kitchen worker wellbeing during organic food conversion

Earlier evaluations of organic food conversion projects have highlighted the importance of kitchen worker engagement and motivation^(144,145). In practice, a successful conversion has required good communication among kitchen workers, management and users as well as an empowering working environment^(111,137). Motivation has been especially important as the conversion process has proved to become increasingly challenging the higher the organic food percentage levels⁽¹³⁷⁾. Results from a Danish qualitative study with kitchen workers during organic conversion indicated that to qualify for the Organic Cuisine Label in gold (90-100%), public kitchens were required to buy whole animals and independently process it into meat-cuts, meat-topping products and flavouring stocks for soups which necessitated a high level of equipment, training and motivation among the workers⁽¹³⁷⁾.

One earlier evaluation of organic food conversion projects found that the one effect identified most often among the different conversion projects is increased joy of working with organic food procurement experienced by kitchen workers⁽¹²³⁾. This was followed by increased competencies gained by kitchen workers and increased knowledge of organic food production among both kitchen workers and users⁽¹²³⁾. These findings were supported by a recent analysis of these conversion projects which also added increased commitment to the public procurement setting among stakeholders such as municipal decision-makers, suppliers, food producers, kitchen worker and managers and kitchen users⁽¹¹¹⁾. Increased information and transparency among these stakeholders following the conversion projects were found, improving networks and working environments⁽¹¹¹⁾. During qualitative interviews with conversion consultants, these effects were found to be crucial to the conversion process in terms of ensuring motivation for an ongoing organisational development and to anchor the results in the long-term⁽¹²³⁾.

The existing knowledge on public kitchen worker wellbeing in relation to organic food conversion is limited. One semi-qualitative questionnaire study from Denmark exploring kitchen worker wellbeing in public childcare kitchens during an organic food conversion indicated positive effects on the working environment due to increased meaning of work, competence building and increased knowledge on organic food production and nutrition⁽¹⁴⁵⁾. To put these findings into perspective, a Danish qualitative interview study on catering products from 1996 with kitchen workers from 40 public kitchens explored kitchen workers' needs and attitudes towards the food products available in catering⁽¹³⁴⁾. This study showed that the kitchen workers wished for time-saving food products with long lasting durability but when asked about their future motivations, they wanted to prepare seasonally good quality meals from base, please the kitchen users, serve food they would be proud of and experiment in food production⁽¹³⁴⁾.

In 2007, another elaborate qualitative interview study with public kitchen workers found a slight change of focus in opinions in relation to priorities in public procurement, from a wish of convenience products to a clearly expressed wish of fresh and home-made food⁽¹²⁰⁾. Streamlining and technological modernisation of the public institutions might have shifted kitchen worker priorities in the meantime towards traditional food production principles, re-establishing a close link between food products, cooking and eating as well as improving food quality, working environment, user satisfaction and dining environments⁽¹²⁰⁾. This qualitative study provided valuable insights into kitchen worker aspirations of expressing care through presence, settings, activities as well as food⁽¹²⁰⁾.

Potential conflicts between implementing organic procurement and these points has been brought forward, in that meals produced from base rather than applying convenience products may introduce a time-pressure to the extent that working and eating environments are compromised⁽¹²⁰⁾. However, improving the meal-quality holistically and beyond food production has been promoted in the organic food conversion process currently implemented, and conversion consultants argue that satisfying working environments as well as meal settings should be integrated dimensions of organic public procurement rather contrasting factors⁽¹⁵³⁾.

The published literature on public kitchen worker wellbeing during organic food conversion is limited and literature from the field of catering and hospitality may therefore also be relevant to consider. Danish as well as international studies, including a Danish cohort and a systematic review, have indicated that kitchen employees generally have been faced with tight timelines and limited resources with which to meet strict nutritional recommendations, which could have affected psychological and physical wellbeing negatively through changes to posture, force, repetition and duration^(154–158).

Also regarding stress moderation and job-control, results suggest that job influence and management support may buffer negative effects of job demands and potentially increase job satisfaction and motivation^(158,159). Results from a 20-month long longitudinal interview study from England including 74 school kitchen employees measured perceptions of kitchen employees on their employment and professional development following the implementation of Food For Life Partnership (whole school food programme), and found that increased employee involvement resulted in greater motivation and job satisfaction despite new challenges⁽¹⁶⁰⁾. In a Finish example, a two year intervention study among 85 schools in Espo measured kitchen employee wellbeing following a training programme on “work process knowledge” and also report increased levels of job satisfaction⁽¹⁶¹⁾. Despite the lack of direct comparisons to organic food conversion similar to the projects in the Danish Organic Action Plan 2020, it might be argued that these examples share similar frameworks in terms of training and knowledge processing in coping with new challenges. Employee involvement and motivation are therefore highlighted once more as potential contributing factors to increased wellbeing at work in public kitchens.

In summary, results available from the field of kitchen worker wellbeing during an organic food conversion as well as knowledge from the field of wellbeing at work in catering has been presented to improve the understanding of the area. The literature suggests that physical wellbeing greatly depends on posture, force, repetition and duration, elements that an organic food conversion is likely to challenge and potentially affect negatively. Psychological wellbeing is influenced by demands at work, organisation and content of the work, cooperation and management and values at the workplace, which can be positively or negatively affected by an organic food conversion depending on the efforts implemented to build competencies and engage kitchen workers. Former experiences with increased motivation among kitchen workers during an organic food conversion may indicate potential for counterbalancing increased physical demands as a result of implementation of organic public procurement.

1.3.5 Effectiveness of organic food conversion projects

The general conversion process described above highlights several potential effect areas of an organic food conversion such as use of organic foods, food waste reduction, plant-based menus, application of nutritional guidelines, procurement quality, planning skills, knowledge and competencies of the public kitchen workers and overall unity within each public kitchen^(111,123).

Evaluations of previous governmental initiatives on organic public procurement were based on semi-qualitative interviews with a limited number of kitchen workers, kitchen users and conversion project managers and may have been limited in representativeness^(111,123,145). These qualitative evaluations have provided valuable information in terms of potential indirect effects of

organic food conversion projects along with knowledge on barriers for organic public procurement, which has been crucial in order to improve the cooperation between public kitchens, supplier and food producers^(121,123,145). Yet, this research area should generally be strengthened by further studies, including quantitative effectiveness measurements to base future conversion initiatives on.

The main direct effect of organic food conversion would arguably be an increased organic food percentage of the public kitchen procurement. This effect would therefore be the most important to establish to consider the actual effect-size of the conversion projects and potential associations to other effect areas. The current literature has suggested that organic public procurement indeed increased during the conversion projects implemented through former governmental initiatives, with changes in the majority of public kitchens ranging from 10-100% increased organic procurement⁽¹²³⁾. However, these were based on self-reported evaluations, most likely originating from calculations using the Dogme method which may have introduced uncertainties as described above.

Hence, it seems likely that the conversion projects implemented so far have been successful in increasing the organic food percentage in the participating public kitchens, but specific and valid measurements of change are still lacking in the evidence-base.

Potential indirect effects of organic food conversion

In terms of indirect effects, the strength of the evidence could be improved. Kitchen worker wellbeing was highlighted above as potentially the most important indirect effect by representing both an important influential factor during implementation as well as an effect of organic food conversion. Regarding evidence on other indirect effects of conversion projects, a recent smaller longitudinal study suggested a significant reduction in food waste during an organic food conversion⁽¹⁶²⁾. The study sample size included two workplace canteens with 200-500 daily users and measured buffet serving waste, plate waste and production waste before and after organic conversion. Both kitchens had an organic food percentage of 7% at baseline, which increased to 42% and 53% at endpoint and in the same process, food waste during production was reduced from 24,2% to 2,8% in one of the kitchens⁽¹⁶²⁾. Though no casual association could be concluded upon, the results may be considered indicative.

In terms of food and nutritional quality, no studies have been published measuring changes following an organic food conversion, but one cross-sectional analysis among 179 schools indicated a healthier eating environment in organic schools⁽¹⁶³⁾. Furthermore a quantitative questionnaire study found that the organic food conversion processes may result in diet compositions more in line with national food-based dietary guidelines for the general population

by being based primarily on vegetables and legumes rather than meat^(164,165). In a Finnish example a sustainable strategy for development was implemented and 19 municipal kitchens in Kiuruvesi were encouraged to apply local and organic food products⁽¹⁶⁶⁾. Results included increased purchasing of organic food products and improved effects on both local economy and employment yet again, no specific measurements were reported⁽¹⁶⁶⁾.

Kitchen user satisfaction has also been explored after initiating organic food conversion in three elderly care kitchens. The study included a before-after measurement design with a considerable loss to follow-up of kitchen users (n=321 before and n=175 after) but did include a control group. The results suggested that elderly kitchen users were difficult to interview due to old age but overall, users expressed less satisfaction with the food procurement at follow-up. This was also found in the control group and so decreased satisfaction with the food among the elderly kitchen users may not have been caused by the conversion project⁽¹⁴⁵⁾.

The organic food conversion process has been suggested to have several beneficial effects to the registered level organic procurement, kitchen worker wellbeing, food waste, nutrition and user satisfaction but with the limited amount of studies conducted so far, these effects remain indicative. Further research in this area is warranted.

1.4 Project development

1.4.1 Preconditions and assumptions

This PhD study was initiated alongside the launch of the Danish Organic Action Plan 2020. The study intended to evaluate the programme impact in a broad context within which typical preconditions as well as setting-specific preconditions influenced the research design from the outset^(167,168). As in most impact evaluations, constraints to time and budget posed barriers regarding length of study, the number of research areas to be prioritised and the possibility to recruit and include an appropriate control group to strengthen the design⁽¹⁶⁹⁾.

The research setting further introduced concrete methodological preconditions to this study. Firstly, the organic food conversion projects receiving funding from the Danish Organic Action Plan 2020 as well as the public kitchens participating in them were pre-selected, as project funding was granted by the Danish Agri-Fish Agency and public kitchens recruited within the individual conversion projects. Selection criteria for both conversion projects as well as participating public kitchens were established before this study and were unlikely to be based on scientific randomisation, raising concerns of selection bias. Secondly, while managers behind successful conversion project applications may have been interested in collaborating

with research, reasons behind participation among the public kitchens varied along with their willingness to cooperate. Thirdly, the organic food conversion projects receiving funding were responsible for each their individual intervention and thereby all inputs and activities associated with implementing organic public procurement. These activities varied within each conversion project and research had limited possibilities to prevent threats to validity in terms of attrition, spillover and noncompliance.

In relation to these preconditions, a number of assumptions made in the planning of this PhD study should be clarified. It was assumed that conversion projects receiving funding were of a certain standard regarding experience, content and size to ensure that conversion projects entering the study were able to fully implement organic food conversion in each participating public kitchen according to the time-plan in their applications. It was further assumed that conversion projects were prepared, planned and ready to initiate implementation once their applications were granted, meaning that baseline and follow-up measurements could be planned close to official application deadlines and project ending deadline. Also, conversion projects receiving funding, and to a certain extent also the public kitchens within each project, were expected to meet the statutory requirements within the initiative, including collaborating with research during data collection.

1.4.2 Project delimitation and changes

The literature review presented above suggests that human health, nutrition and sustainability are relevant areas to consider in research on organic food production and procurement regarding food production methods, food content and dietary patterns associated with organic food. When narrowing the area further down to organic food conversion in public kitchens, the review also shows that most of the present knowledge from Denmark and abroad builds on a limited number of qualitative interviews and observations in studies exploring the details of the conversion process and potential effects of it, but with few or no quantitative measurements.

The overall aim of this PhD study is to strengthen the evidence base on organic food conversion in public kitchens by contributing with quantifiable measurements of organic food conversion. The list of possible effect measurements from the review is long but priority has been given to the following four topics: organic food percentage, wellbeing at work among kitchen workers, nutritional procurement profile and the level of food preparation in procurement. These areas have been chosen based on relevance as well as what was considered a realistic scope of this study. The first topic studied, organic food percentage, is a central indicator of increasing public procurement without which no other associations can be scientifically evaluated and these measurements are therefore important for both this and future research in this area. Justification for including the second topic, wellbeing at work among kitchen workers, relates to future public

health concerns and the need for exploring the long-term sustainability of the conversion projects. More knowledge of effects on kitchen worker wellbeing should be considered before promoting future initiatives on organic public procurement and also, changes to wellbeing have shown to be potential indicators of the conversion projects' long-term prospects after grant funding have ended.

The third topic is nutritional procurement profile, which involves measuring potential changes to the different food groups procured by the public kitchens by investigating tonnage of the categorised food groups before and after conversion on procurement level. Such measure could be used as an indicator of the food produced and served by the public kitchens and to what extent this may or may not have shifted towards more plant-based diets, which again could be a measurement with interesting outcomes of public health relevance. Finally, the fourth topic involves the level of food preparation on procurement level, measuring potential changes to procurement in terms of food products within different categories of processing. This measure can be used as an indicator of whether public meals have become more or less produced from base.

Project changes

At baseline measurements of the organic food percentage during the initial conversion projects funded in fall 2012, it became clear that changes to the project plan was necessary. In practice the initial measurements of organic food percentages were greatly delayed and extended due to challenges of measurement procedure within the public kitchens in each conversion project. The Organic Cuisine Label method was new to most public kitchens, suppliers and conversion projects and before the Organic Cuisine Label method was established, another measuring method called the Dogme method from 2005 was used⁽¹⁷⁰⁾. The Dogme method has been an online measurement tool automatically assessing the organic food percentage of the individual public kitchens based on self-reported procurement habits and kitchen background information by kitchen workers. The model has been intended as a temporary solution for internal progress evaluations rather than official registrations until more sustainable authorised methods, such as the Organic Cuisine Label, had been developed.

However, the transition from applying the Dogme method to applying the Organic Cuisine Label method caused difficulties⁽¹³⁷⁾. Qualitative research suggested implementation challenges in relation to the Organic Cuisine Label method in terms of adjustments to kitchen-supplier collaborations along with potential doubts about definitions, documentation requirements and the overall application process associated with the Organic Cuisine Label experienced by the public kitchens⁽¹³⁷⁾. Hence both organic food percentage measurement methods were being

applied among the participating public kitchens for the baseline measurements, which introduced severe implications to the scientific evaluation of organic food conversion progress. Additional research was needed to compare the measurements of the two different methods and scientifically assess whether measurements from both methods could be included at baseline. In order to ensure that the inclusion of baseline measurements of organic food percentages measured by the two different methods would not weaken the strength of the effect measurements, a comparison study of the methods had to be designed and conducted, causing changes to the project plan. Changes also had to be considered following a preliminary study of public kitchen procurement invoices, investigating the level of detail and applicability of the invoices in terms of dividing the procurement into food groups and preparation level. This process turned out to be time-consuming and extensive with even a small selection of public kitchens considering the time available for this research.

Faced with further restrictions to time and budget resources, priority was given to investigations of organic food percentages and wellbeing among kitchen workers since knowledge in these two effect areas was considered most important for justifying future organic public procurement. In recognition of the relevance of including nutritional aspects in this research, measures of kitchen worker opinions of food quality and nutritional guideline application were included in the second topic of wellbeing. These measures were no longer objective but rather subjective to the kitchen worker but would still be valuable to the overall effect of the organic food conversion projects.

Reducing the effect measurements from four to two and instead including the comparison study was necessary to intensify the resources in a more narrow direction, increasing the strength of the research conducted.

2. Aim of the PhD study

2.1 Hypotheses

The hypothesis of this PhD study is that the organic food conversion projects in the Danish Organic Action Plan 2020 will result in a significant increase in the organic food percentage in the participating public kitchens within the conversion period.

Further, it is hypothesized that the conversion process will affect the wellbeing at work experienced by the kitchen workers both regarding psychological (potentially negatively as well as positively) and physical wellbeing (potentially negatively).

2.2 Aim and objectives

The overall aim of the PhD study is to contribute to the scientific evidence base on the effectiveness of organic food conversion in public kitchens with regard to quantitative measurements of organic food percentages and kitchen worker wellbeing. More specifically, the objectives are:

- To collect baseline organic food procurement measurements from public kitchens participating in the Danish Organic Action Plan, including comparisons of organic food percentage measurements by the Organic Cuisine Label method and the Dogme method in a selected sample of public kitchens (Paper I).
- To measure the effectiveness of organic food conversion projects from the Danish Organic Action Plan 2020 on the organic food percentage in the participating public kitchens and secondly, to map the curriculum content of the organic food conversion projects (Paper I and II).
- To measure the effectiveness of organic food conversion projects on experienced physical and psychological wellbeing among kitchen workers in public kitchens participating in the Danish Organic Action Plan 2020 and to measure potential changes to kitchen worker beliefs and attitudes towards organic food conversion (Paper III).

3. Methods

3.1 Overall framework of the study

Since the launch of the Danish Organic Action Plan 2020, companies, organisations and educational institutions have been able to apply for funding in timed intervals organised by the Danish Agri-Fish Agency. The first two intervals called for applications during fall 2012 and spring 2013. These applications included detailed descriptions of the applicant organisation, the number of public kitchens they aimed to reach, the project educational content, experience of the conversion managers and applicant organisations and the level of organic public procurement the project aimed for.

In total, six applicants received grants during fall 2012 and four received grants in spring 2013, all of which were initiated before summer 2013 by the Danish Agri-Fish Agency. The public kitchens participating in the projects were selected by the project managers of the conversion projects. The conversion projects applied different methods for recruiting the participating public kitchens depending on their network, previous conversion experience and contacts, location of the public kitchens along with the political support and engagement in the conversion process within the different municipalities.

The educational content of the 10 conversion projects was developed and implemented by each individual conversion project according to the project descriptions. In terms of data collection, the Organic Cuisine Label method was included as an official specification in order to ensure a common collaborative agreement among stakeholders of applying one single method defined by authorities, the most valid possible.

Kitchen type categories

For all three papers, the same eight different kitchen type categories and definitions of these were applied, specified according to categories developed by the Danish Diet and Nutrition Association⁽¹³⁵⁾ (Christiansen 2000): childcare, school, afterschool, canteen, elderly, hospital, central and residential. **Childcare** included all childcare institutions such as nurseries, kindergartens and integrated institutions; **School** included school canteens and school-cooking classes; **Afterschool** covered institutional after-school care; **Canteen** included canteens or cafés associated with workplaces, universities, activity centres or cultural venues; **Elderly** included institutional homes for elderly; **Hospital** covered patient procurement in hospitals; **Central** included large-scale food production kitchens delivering meals to receiving kitchens; **Residential** included institutions in which consumers live permanently (i.e. social care facilities, university boarding schools and barracks). The kitchen types differed in number of main and in-

between meals produced per week depending on their target group, opening hours and production systems. Overall, kitchen types open for production five days per week included childcare, school food, after-school and canteen, whereas kitchen types open for production seven days per week included elderly, hospital, central and residential.

3.2 Measuring the organic food percentage (Paper I)

3.2.1 Kitchen background information

Public kitchen background information was collected online from a kitchen representative from each public kitchen. This information included kitchen type, number of workers, number of kitchen users and meals produced and was collected using LimeSurvey⁽¹⁷¹⁾ questionnaire design to ensure appropriate comparisons of the organic food percentages. The questionnaire was developed by the research team.

3.2.2 Collection of organic food percentages

Organic food percentage measurements from each participating public kitchen before and after implementation of the conversion project were collected in collaboration with kitchen workers, the conversion manager from each conversion project and this PhD study. Each public kitchen was responsible for registering procurement data in the Organic Cuisine Label method spreadsheet with guidance from conversion managers. The spreadsheet calculations were then forwarded to the PhD candidate and coupled to public kitchen background information. Organic food percentages as well as public kitchen background information collected in relation to the comparison study of the two measurement methods (Paper I) were collected by the research team.

3.2.3 Comparison of two measurement methods

A sample of 26 public kitchens was selected by the research team from the participant list of the Danish Organic Action Plan 2020 based on the following criteria: 1) kitchens should be either a childcare or elderly care institution, 2) be able to apply both methods and 3) the total sample should represent levels of organic food procurement between 1-99% to compare measurements from the full spectrum. Childcare and elderly homes were selected because these two types represent the majority of participating kitchens in the Danish Organic Action Plan 2020. Kitchens were excluded from the comparison study if they documented an organic food percentage of 0% or 100% as variations between the methods would not be detected at these levels and also, if the kitchens were located outside greater Copenhagen due to transportation restrictions.

To estimate the organic food percentage according to the Organic Cuisine Label method, invoices of public kitchen procurement during a three-month period were collected for each kitchen by the research team. The total procurement was entered into the Excel calculation spreadsheet developed by Danish Veterinary and Food Administration in either monetary value (Danish Kroner) or weight (kilograms)⁽¹¹³⁾, targeting all kitchen types and can be downloaded freely online⁽¹¹⁴⁾. In the Excel sheet, total procurement was divided into organic foods, non-organic foods and neutral goods such as non-food products, water, salt and game or wildlife and from these the organic food percentage was calculated automatically. The Dogme web-based model was also available for all kitchen types freely online⁽¹⁷⁰⁾. Organic food percentages according to the Dogme method were estimated for each kitchen by entering self-reported kitchen background information on type, budget, total procurement tonnage and self-reported use of organic products into the model for an automatic calculation. This information was collected from an employee from each public kitchen included in the comparison study.

3.2.4 Baseline evaluation of the Danish Organic Action Plan 2020

At the time of this baseline evaluation, only the first six organic food conversion projects had received funding from the Danish Organic Action Plan 2020 during fall 2012. The remaining four conversion projects had not yet been identified and so, only the first six were included for the baseline evaluation in order to evaluate appropriate measurements of the organic food percentage as early in the process as possible.

Public kitchens from all six projects participated by measuring the organic food procurement using the Organic Cuisine Label method. The Dogme method was accepted in cases where the Organic Cuisine Label method was not applicable and method application was registered to account for the number of measurements by the Dogme method. Kitchen background information was collected using a LimeSurvey⁽¹⁷¹⁾ web-based questionnaire and coupled to the reported organic food procurement estimates.

3.3 Effect on the organic food percentage (Paper II)

3.3.1 Recruitment

The change in organic food percentage in Danish public kitchens was measured during a longitudinal study with baseline and follow-up measurements following the organic food conversion program. The six conversion projects from fall 2012 and the four projects from spring 2013 receiving funding from the Danish Organic Action Plan 2020 were all included in the study, counting a total of 666 public kitchens. Participating public kitchens from all 10 conversion

projects were included in order to increase the total sample size as much as possible. As these public kitchens had already been recruited by the conversion projects, they were planned to complete the conversion intervention and therefore represented a valuable opportunity for research on effects on the organic food percentage. One of the 10 projects including 19 public kitchens was later excluded from the study due to an extended conversion period. Of the remaining 647 public kitchens, 36 were combined to 13 during the conversion period and two were lost to follow-up. This leaves 622 public kitchens divided into the eight different types identified in Paper I completing the conversion projects over a median conversion period of 1.5 years. Organic food percentages by the Organic Cuisine Label method combined with the kitchen background questionnaire were collected for each kitchen at baseline as well as follow-up, following the same fashion as in the baseline status study (Paper I).

3.3.2 Selection of curriculum components

Additionally, educational curriculum from each conversion project was mapped according to official project descriptions. This mapping was carried out to improve the understanding of the differences in educational approach towards organic food conversion among the nine projects. Based on previous literature on organic food conversion in public kitchens highlighting specific steps within organic food conversion projects^(15,111,119,120,125,132,137) as well as pilot-discussions with experienced conversion managers responsible for six of the nine implemented conversion projects, 12 curriculum components were identified as especially relevant for the organic food conversion process:

- “Mapping of kitchen production system before start”
- “Theory of organic food (production, health, environment)”
- “Past experiences and success-stories on conversion”
- “Practical cooking classes (local and seasonal)”
- “Nutritional guidelines relevant for kitchen users”
- “Menu-planning with new production systems”
- “Budgeting for more organic food within previous budget”
- “Food-waste lessons on re-use of leftovers”
- “Fieldtrips for kitchen workers to farms and producers”
- “Network between/among kitchens, suppliers and producers”
- “Organic Cuisine Label method introduction and application”
- “Follow-up visit offers to individual kitchen participants”

These 12 components were included in the conversion project descriptions or expressed by the conversion managers during pilot-discussions. The pilot-discussions were held with conversion managers representing six conversion projects, the discussions were held individually at the

end of the conversion projects and were based upon each of the conversion project descriptions of the respective projects. The conversion managers were asked to elaborate on their project content to clarify the specific meaning of the different points in the description and to confirm whether this content in fact had been implemented. The conversion managers were also asked whether project content had been excluded from the conversion projects at any stage and for what reason and lastly, whether additional curriculum components would have been included if budget resources and time were no barriers.

Once the list of relevant components had been made, this was compared to the findings in the literature. All nine conversion managers were contacted after completing the mapping of each individual project to allow for potential objections.

3.4 Wellbeing at work among kitchen workers (Paper III)

3.4.1 Development of questionnaire

An online questionnaire was developed based on literature on questionnaire construction^(172–174) and consultations with experienced advisors in public kitchen workplace, discussing the most appropriate parameters to include along with the quality of already established and identified questionnaires. Based on this guidance, three established and either nationally or internationally validated questionnaires were selected for application in the final online questionnaire in this study^(135,175–180). The first questionnaire was chosen due to its relevance in the area of public procurement, including tailored terminology and question formulation appropriate for collecting public kitchen background information⁽¹³⁵⁾.

The second questionnaire was the Copenhagen Psycho-Social Questionnaire (COPSOQ) which has been through extensive quality testing and has been applied internationally with strong results of validity and reliability regarding psychological wellbeing measurements^(175,178,180). Lastly, the third questionnaire selected included specific and useful questions on physical wellbeing. This questionnaire has also been tested extensively in terms of measurement validity and reliability at national level as it has been applied alongside the COPSOQ in a Danish national cohort study since 1990 on working environment and health by the National Research Centre for the Working Environment (NRCWE)^(176,181).

The final questionnaire applied in this study had to be as concise as possible and so only the most important parameters were included. This meant that only the most relevant background information was asked for, that the shortest version of COPSOQ available was used and even from here only the most relevant parameters were selected and finally, parameters on physical

wellbeing was limited to the most known areas within the public kitchen field. According to the expert guidance, the selected parameters could not be condensed further by removing integrated items without interfering with the validity of the individual parameters. The final online questionnaire therefore included a total of 25 questions divided into five sections of which the first three were based on established questionnaires: background information⁽¹³⁵⁾ psychological wellbeing at work⁽¹⁷⁵⁾, physical wellbeing at work⁽¹⁷⁶⁾, beliefs and attitudes.

In relation to the last two questionnaire sections, expert advice, field visits and pilot-testing were conducted in order to formulate and tailor the questions best possibly to this study in combination with the other sections⁽¹⁸²⁾. Field visits were carried out in a sample of three childcare kitchens, three elderly care kitchen and one canteen all of which had experiences with organic food conversion.

In each kitchen, a representative kitchen worker was informally interviewed on their experiences in terms of changes in wellbeing at work to guide the relevance of the questions. Once more, an expert consultant in public kitchen workplace evaluations was interviewed to discuss question selection, appropriate questionnaire development and analysis. Lastly, the completed questionnaire was pilot-tested and adjusted in collaboration with the same kitchen representatives interviewed during the field visits.

The following 12 dimensions made up the parameters measuring psychological wellbeing, each evaluated by two questions and with 0-4 ordinal scale response options:

- Quantitative demands
- Tempo (work pace)
- Emotional demands
- Influence at work
- Possibilities for development
- Meaning of work
- Commitment to the workplace
- Predictability
- Rewards (recognition)
- Role clarity
- “Vertical trust” (between management and workers)
- Justice and respect

The following six parameters measured physical wellbeing with one question each and also with 0-4 ordinal scale response options:

- Self-rated physical fatigue after a normal day of work (in general)
- Self-rated physical fatigue (back)
- Self-rated physical fatigue (neck and shoulder)
- Self-rated physical fatigue (arms and wrists)
- Self-rated physical fatigue (legs)
- Self-rated physical work ability

Kitchen worker beliefs and attitudes included parameters on perceived food quality, experiences with kitchen user recognition, motivation to work, application of nutritional guidelines and food flavouring practices. They were measured at baseline and follow-up with one question each. Additionally four questions were added at follow-up to clarify kitchen worker considerations regarding the organic food conversion process, asking for potential effects on their experienced work satisfaction, motivation, joy and workload, all with five response options for each question. Overall, measurements at baseline and follow-up were conducted in the same fashion, except for these additional four questions on personal considerations of the kitchen workers in relation to the organic food conversion process, which were only appropriate to add at follow-up.

3.4.2 Survey design

The survey was designed as a longitudinal study with baseline and follow-up measurements before and after the implementation of organic food conversion in Danish public kitchens. Experienced wellbeing at work among kitchen workers in the participating public kitchens was measured by an online self-administered questionnaire, using LimeSurvey programming. All responses at baseline as well as follow-up were automatically submitted through LimeSurvey and exported into Excel for data analysis.

Baseline measurements were collected in September 2013 and follow-up measurements one year later, during which the conversion project had been implemented. In order to meet eligibility requirements for this study, the public kitchen workers were not to have initiated the conversion projects at baseline. At the time of baseline measurements, one organic food project from fall 2012 and three conversion projects receiving funding from the Danish Organic Action Plan 2020 in the spring of 2013 were eligible for inclusion. The one project from fall 2012 had not initiated the conversion project in the participating public kitchens due to an extended planning period within the project. In total, these four conversion projects included 170 public kitchens and employed 448 kitchen workers across Denmark. The kitchens were categorised according to the eight kitchen types introduced earlier.

The questionnaire was anonymous for reporting purposes but personal work emails were used for participation and to pair baseline and follow-up measurements. The survey was targeted every staff member assisting in food preparation after informed consent was obtained. Kitchen workers were invited to participate directly by email and if not possible, through institution head staff or conversion project managers. Where personal work emails did not exist and official kitchen or institution email addresses were used for participation of each kitchen worker, coupling of baseline and follow-up measurements were not possible. If three email requests were left unanswered, the kitchen workers were attempted contacted by telephone and this procedure was followed during recruitment and follow-up measurements.

3.5 Data analysis (Paper I, II and III)

For the comparison study (Paper I), the two methods were evaluated through the Spearman correlation to account for non-normally distributed data⁽¹⁸³⁾ and complemented by a Bland-Altman plot of agreement between the measurements by the two methods. This combination was chosen in order to test the statistical dependence between the pairs of percentage observations by the Organic Cuisine Label method and the Dogme method and to evaluate any systematic differences between them. Limits of agreement were defined as two times the standard deviation of the differences above and below the mean⁽¹⁸⁴⁾. The baseline evaluation was used to describe the characteristics of the public kitchens participating in the initial six conversion projects receiving funding. The data analyses were kept to descriptive statistics to present these public kitchens and their level organic procurement appropriately.

In terms of the effectiveness of organic food conversion (Paper II), the organic food percentage among all 622 public kitchens was defined as the proportion of organic food procured by the individual kitchens, both according to the four relevant Organic Food Cuisine label intervals as well as the specific percentage measurements. Following visual illustrations of the data distribution, the paired ordinal organic food percentage measurements was not considered normally distributed and therefore non-parametric statistical hypothesis testing of differences between baseline and follow-up in the form of Wilcoxon signed rank test was applied. The differences were analysed for all 622 public kitchens as well as the eight kitchen types and reported with the median values along with 1st and 3rd quartiles.

Changes in wellbeing at work (Paper III) were analysed through both paired and unpaired analyses. The unpaired analyses included all responses obtained at baseline and follow-up, whereas the second round of analyses included only responses from individuals with paired baseline and follow-up measurements. Parameters measuring physical and psychological

wellbeing at work were treated as continuous variables including calculations of the mean values, differences in the mean and 95% CI between baseline and follow-up. Significance testing of difference between baseline and follow-up were made using unpaired and paired t-tests for the two types of analysis and where the data were proportions the comparisons were made using chi-squared significance tests. Due to the large number of comparisons, the significance cut-off value was set at $p=0.01$ to minimise the risk of drawing false-positive conclusions.

Statistical analyses were carried out using R statistical software package version i386 3.0.2 (R Inc., Boston, Massachusetts, USA).

3.6 Ethical considerations

The studies were performed in accordance with the ethical standards of the Helsinki Declaration of 1975, as revised in 2008⁽¹⁸⁵⁾. An ethical clearance was not needed according to the national act on Ethical Treatment of Scientific Projects in Health Research, Regulation no. 593 of June 2011, article 14, second paragraph⁽¹⁸⁶⁾ as these studies were non-medical questionnaire surveys with no data collection of human biomaterial or personal information.

4. Results

4.1 Measuring the organic food percentage (Paper I)

4.1.1 Comparison of two measurement methods

Both the Organic Cuisine Label method and the Dogme method were applied in the study of 26 public kitchens. Results from the Spearman correlation coefficient included a correlation of 0.83 ($p < 0.001$) between the measurements of organic food percentage. This correlation was confirmed by the high level of agreement between the measurements illustrated in the Bland-Altman plot (Paper I), with a bias of -6% and limits of agreement between -37% and 25%. Nonetheless, outlying estimations were also identified at intervals between 55-75 % according to the Dogme method and between 30-45 % according to the Organic Cuisine Label method. As the mean difference (bias) was negative, the results suggest an increased level of uncertainty in measurements of organic food procurement by the Dogme method in the 55–75% interval⁽¹⁸⁷⁾.

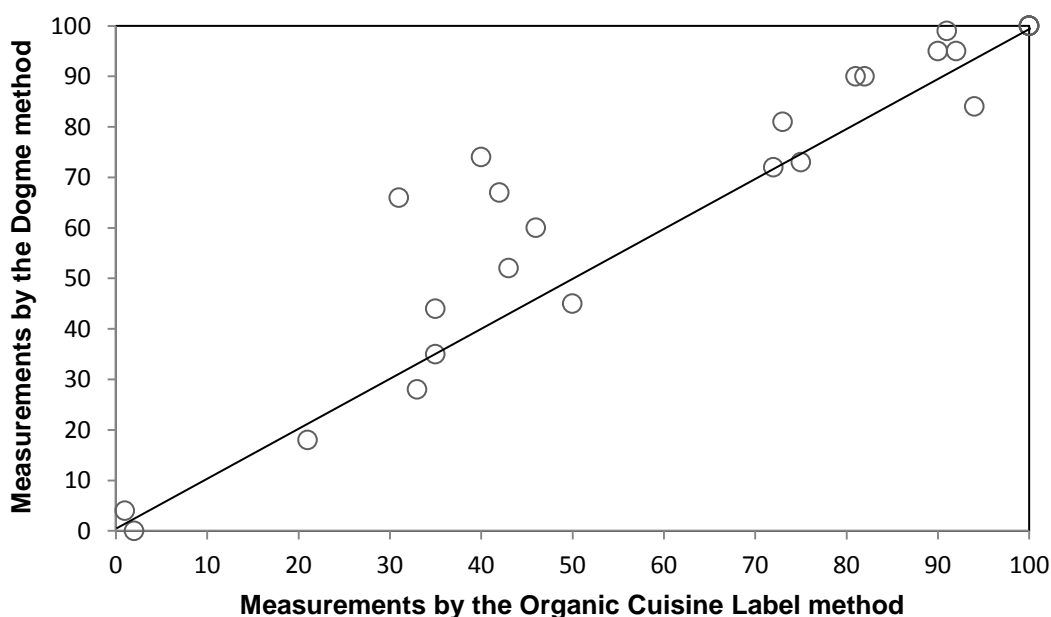


Figure 4.1 Comparison of organic food procurement measurements by the Organic Cuisine Label method and the Dogme method among twenty-six public kitchens participating in the Danish Organic Action Plan 2020. The Spearman correlation coefficient between the two measurement methods was found to be significant ($r=0.83$, $P<0.001$)

4.1.2 Baseline evaluation of the Danish Organic Action Plan 2020

From the six conversion projects participating in the Danish Organic Action Plan 2020 by the time of the baseline status, a total of 349 public kitchens were included. Of these, data collection was completed for 345 and four kitchens were excluded due to lacking measurements of either the Organic Cuisine Label method or the Dogme method.

In terms of method application, 255 (74%) public kitchens applied the Organic Cuisine Label method during the baseline measurement. The rest applied the Dogme method. Of the kitchens who applied the Dogme method, 4% were in the 55-75% interval.

The overall weighted mean organic food procurement of the eight different kitchen types including measurements from both methods was found to be 24% (please see Paper I for further details).

Regarding mean organic food percentage levels according to the Organic Cuisine Label intervals, childcare, school and elderly care kitchens included the highest levels with childcare and elderly care kitchens qualifying for the bronze label (30-60%) on average at baseline (Table 4.1). Half of the childcare kitchens (n=106) were qualified for either a silver or gold label, where hospitals and central kitchens were among the kitchen types with the lowest mean organic food percentage with no kitchens qualifying for more than the bronze label at baseline. Despite being few in numbers, hospitals and central kitchen types registered the largest number of kitchen workers and meals produced all public kitchens of these two types were able to apply the Organic Cuisine Label method at baseline⁽¹⁸⁷⁾.

Table 4.1 Organic food procurement at baseline in Danish public kitchens participating in the Organic Action Plan 2020 (n=345)

Kitchen type	n	Organic food procurement ^a		Kitchens at Organic Cuisine Label levels (%) ^a			
		Mean (%)	SD	No label (0-29%)	Bronze (30-60%)	Silver (60-90%)	Gold (90-100%)
Childcare	210	56	0.30	22	28	33	17
School	16	29	0.31	63	19	6	12
Afterschool	20	23	0.28	65	20	10	5
Canteen	42	13	0.18	83	10	7	0
Elderly	28	33	0.33	54	18	25	4
Hospital	7	16	0.19	71	29	0	0
Central	4	9	0.08	100	0	0	0
Residential	18	14	0.16	89	11	0	0

^aInclude organic food percentage measurements derived by applying the Organic Cuisine Label method and the Dogme method.

4.2 Effect on the organic food percentage (Paper II)

The main public kitchen types represented among the 622 included kitchens were childcare (56%), canteen (15%), elderly (10%), school and residential (7%), afterschool (3%) and hospitals and central kitchens (1%). Regarding kitchen types with the highest proportion of main meals produced, central kitchens were placed highest (35%) followed by childcare (24%), canteen (14%), elderly (10%), hospital (9%), residential (4%), school (3.5%) and lastly, afterschool (0.5%). Additional details can be found in Paper II.

In terms of method application, 474 (76%) public kitchens applied the Organic Cuisine Label method during the baseline measurement and 615 (99%) at follow-up. The rest applied the Dogme method. Of the 148 public kitchens who applied the Dogme method at baseline, 19% were in the 55-75%.

4.2.1 Change in organic food percentages

Overall for the 622 public kitchens, the organic food percentage increased significantly from baseline to follow-up from a median (IQR) of 38% (6-66) at baseline to 69% (48-83) at follow-up ($p < 0.001$), with a difference in medians of 24 percent point (Table 4.2). Calculating the weighted mean organic food percentage as an average per kitchen type rather than median, in similar fashion as was documented for the baseline evaluation, the result was 22% at baseline and 47% at follow-up. The change remains approximately the same.

Table 4.2 Changes in organic food percentage across kitchen types from the nine different conversion projects during the organic food conversion period from baseline to follow-up

Kitchen type	n	Baseline (%)		Follow-up (%)		Difference Median	P-value ^b
		Median	(IQR)	Median	(IQR)		
All ^a	622	38	(6-66)	69	(48-83)	24	<0.001
Childcare	349	59	(40-78)	81	(70-92)	18	<0.001
School	41	17	(8-35)	49	(26-58)	18	<0.001
Afterschool	18	6	(1-41)	40	(6-54)	8	0.163
Canteen	91	3	(0-15)	43	(31-64)	35	<0.001
Elderly	64	2	(0-23)	51	(41-65)	39	<0.001
Hospital	7	1	(1-29)	20	(9-45)	16	0.022
Central	8	4	(1-17)	40	(31-55)	34	0.016
Residential	44	14	(0-30)	53	(41-64)	35	<0.001

^aOverall calculations included participating kitchens from all projects regardless of kitchen types

^bWilcoxon signed rank test, paired (RStudio)

The increases in organic food percentage remained significant ($p<0.05$) when analysed at the kitchen type level, except for afterschool (Table 4.2). In terms of increasing organic food percentages according to the four Organic Cuisine Label intervals, the total number of kitchens at the 0-30% (no label) level decreased from 270 at baseline to 63 kitchens at follow-up. Public kitchens qualifying for an Organic Cuisine Label in bronze (30-60%) increased from 162 to 174 and for public kitchens qualifying for a silver label (60-90%), an increase was observed from 136 to 282. Lastly, also an increase was found at 90-100% (gold) level from 54 to 103 public kitchens from baseline to follow-up, respectively (Figure 4.2). This means 90% of the participating public kitchens had qualified for an Organic Cuisine Label in bronze, silver or gold at follow-up and 62% were qualified for a label in silver or gold at follow-up.

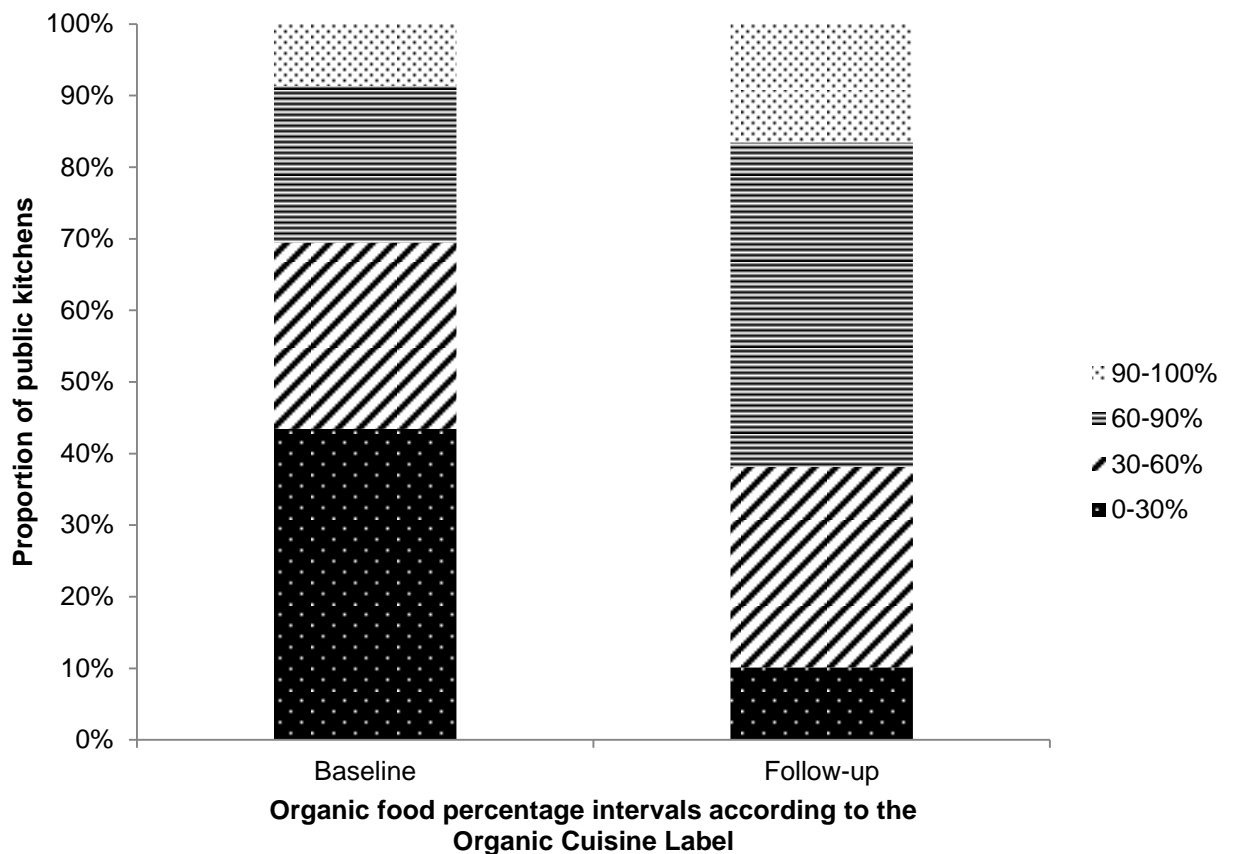


Figure 4.2 Number of public kitchens participating in the nine organic food conversion projects with organic food percentages at the relevant intervals required for the Organic Cuisine Labels measured at baseline and follow-up (n=622)

The change in organic food percentage measurements from baseline to follow-up for each participating public kitchen is also illustrated in Figure 4.3, with few organic food percentage registrations falling below the diagonal.

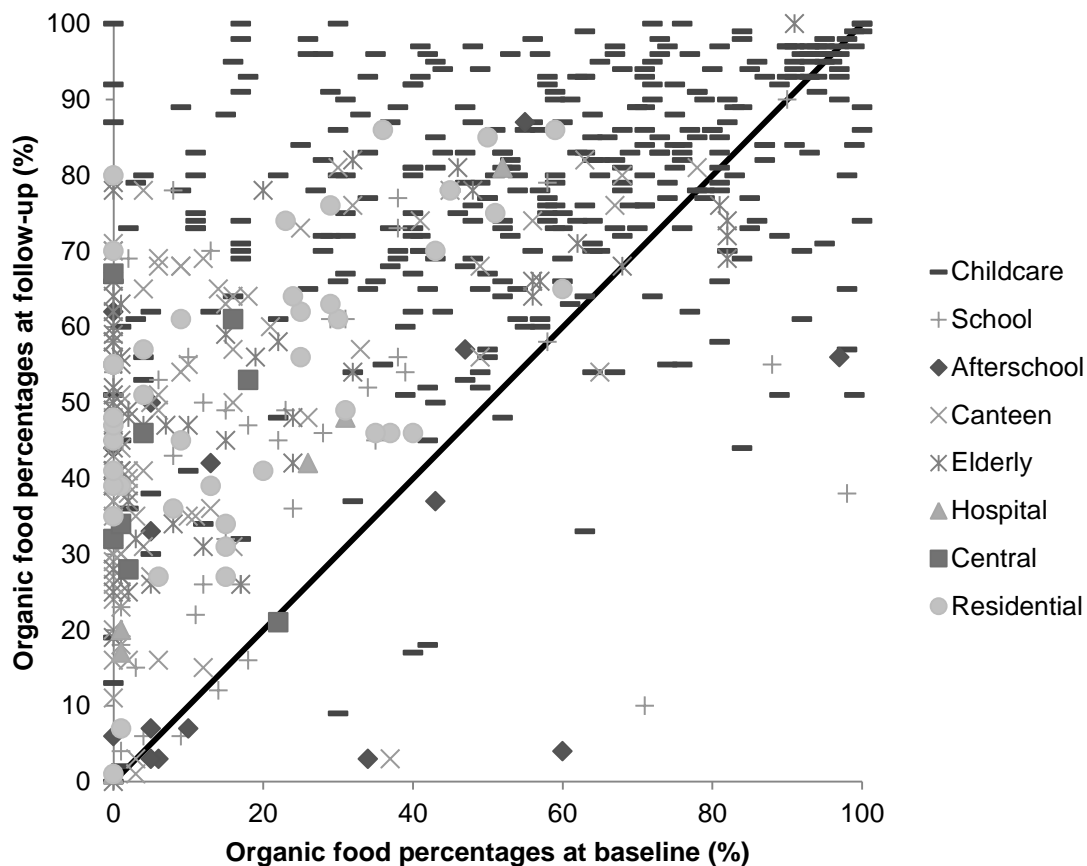


Figure 4.3 Scatter plot of organic food percentage measurements at baseline and follow-up for each participating public kitchen in the nine organic food conversion projects according to the eight kitchen types (n=622). Dots above the diagonal represent public kitchens with increased organic food percentages from baseline to follow-up. Dots below the diagonal represent public kitchens with decreased organic food percentages from baseline to follow-up.

4.2.2 Organic food conversion project content components

The managing organisations behind the nine conversion bodies included producer associations, accounting companies and a university (Table 4.3). In terms of identified curriculum components, four were identified in all nine projects and these involved “Theory”, “Menu-planning”, “Network” and “Organic Cuisine Label method”. Included almost as frequently were the following components, which were identified in eight of the nine conversion projects: “Past experiences”, “Practical cooking classes”, “Nutritional guidelines”, “Budgeting” and “Food-waste lessons”. The remaining three educational components were identified less frequently with seven conversion projects including “Mapping of kitchens”, six including “Fieldtrips”, and two conversion projects including “Follow-up visits”.

Table 4.3 Organic food conversion curriculum components identified in the nine conversion projects implemented in Danish public kitchens

	Conversion projects ^a								
	1	2	3	4	5	6	7	8	9
Conversion project curriculum components									
Mapping kitchen food production system before start		X	X		X	X	X	X	X
Theory of organic food (production, health, environment)	X	X	X	X	X	X	X	X	X
Past experiences and success-stories on conversion	X	X	X		X	X	X	X	X
Practical cooking classes (local and seasonal)		X	X	X	X	X	X	X	X
Nutritional guidelines relevant for kitchen users		X	X	X	X	X	X	X	X
Menu-planning with new production systems	X	X	X	X	X	X	X	X	X
Budgeting for more organic food within previous budget		X	X	X	X	X	X	X	X
Food-waste lessons on re-use of leftovers		X	X	X	X	X	X	X	X
Fieldtrips for kitchen workers to farms and producers	X			X	X	X		X	X
Network between/among kitchens, suppliers and producers	X	X	X	X	X	X	X	X	X
Organic Cuisine Label method introduction and application	X	X	X	X	X	X	X	X	X
Follow-up visit offers to individual kitchen participants			X				X		

^aManaging institution: 1, 3, 5, 7 and 8) Producer Association; 2, 6 and 9) Audit, Accounting and Counselling Company; 4) University

4.3 Effect on wellbeing at work among kitchen workers (Paper III)

In total, 83 kitchens of the 170 eligible were represented at baseline (49%) and 71 at follow-up (86% of those from baseline) with the main kitchen types at baseline being childcare (58%), residential (14%), canteens (12%) and elderly (6%). Both school and hospital kitchens constituted 4% each of the represented kitchens and after-school and central kitchens constituted 1% each. Of all public kitchens included at baseline, 76% reported producing breakfast, 98% lunch, 27% dinner and 87% in-between meals. There were no significant differences between the proportions of kitchen types or reported types of meals produced between baseline and follow-up. Furthermore, 84% of the 87 public kitchens not participating at baseline that were otherwise eligible for participation were childcare kitchens.

Of the 448 eligible kitchen workers, 235 (52%) completed the questionnaire at baseline and 149 (63% of those surveyed at baseline) at follow-up. Participant characteristics remained similar from baseline to follow-up and for the majority this included being female (79%), aged 40-49 (39%), having been working in the kitchen for 1-4 years (32%) at either a hospital (31%) or a childcare kitchen (23%). More information on the characteristics of the included public kitchens and kitchen workers can be found in Paper III.

4.3.1 Unpaired analysis

The unpaired analysis of wellbeing among kitchen workers showed no significant differences between baseline and follow-up for the psychological parameters (Table 4.4). The general body fatigue parameter was the only one of the six physical wellbeing parameters where a significantly ($p=0.004$) higher follow-up score was identified compared to baseline with a difference in means (95% CI) of 0.32 (0.11, 0.53). Also for the following three parameters measuring beliefs and attitudes significantly higher follow-up scores were identified compared to baseline: perceived food quality ($p<0.001$), motivation to work with organic food production ($p=0.01$) and application of nutritional guidelines in food production ($p<0.001$) with differences in means (95% CI) of 0.25 (0.41, 0.35), 0.22 (0.05, 0.39) and 0.56 (0.37, 0.76) respectively.

The additional follow-up questions on kitchen worker considerations showed that 50% of the participants reported a positive/very positive effect of the conversion process on their job satisfaction and 44% reported no change. Regarding joy with work, motivation to work and workload, 53%, 54% and 24% reported a positive/very positive effect and 41%, 36% and 60% no change respectively.

Table 4.4 Changes in parameters on psychological and physical wellbeing at work and beliefs and attitudes amongst kitchen workers during organic food conversion at baseline (n=235) and follow-up (n=149).

Parameters	Baseline		Follow-up		Difference	P-value
	Mean	SD	Mean	SD	Mean (95%CI)	T-test ^b
Psychological^a						
<i>Demands at work</i>						
Quantitative demands	3.8	(0.9)	4.0	(0.8)	0.15 (-0.02,0.33)	0.096
Work pace	3.2	(1.2)	3.0	(1.5)	-0.20 (-0.48,0.07)	0.147
Emotional demands	4.9	(1.5)	4.8	(1.7)	-0.15 (-0.47,0.18)	0.379
<i>Organisation and content</i>						
Influence	5.4	(1.8)	5.3	(1.8)	-0.09 (-0.46,0.29)	0.650
Possibilities for development	5.8	(1.4)	5.9	(1.3)	0.14 (-0.14,0.41)	0.336
Meaning of work	6.5	(1.1)	6.7	(1.1)	0.18 (-0.05,0.41)	0.117
Commitment to the workplace	5.6	(1.4)	5.6	(1.6)	0.01 (-0.30,0.32)	0.942
<i>Cooperation and management</i>						
Predictability	5.1	(1.4)	5.2	(1.5)	0.05 (-0.25,0.35)	0.725
Rewards (recognition)	5.8	(1.3)	5.6	(1.6)	-0.12 (-0.41,0.17)	0.424
Role clarity	6.1	(1.2)	6.0	(1.4)	-0.05 (-0.32,0.21)	0.681
<i>Values at the workplace</i>						
Trust regarding management	6.0	(1.3)	5.9	(1.5)	-0.04 (-0.33,0.24)	0.772
Justice and respect	5.1	(1.3)	5.1	(1.5)	-0.03 (-0.31,0.26)	0.855
Physical						
Body fatigue (general)	2.1	(1.1)	2.4	(0.9)	0.32 (0.10,0.54)	0.004
Back fatigue	2.4	(1.2)	2.6	(1.1)	0.20 (-0.04,0.44)	0.100
Neck and shoulder fatigue	2.3	(1.2)	2.5	(1.1)	0.23 (-0.01,0.47)	0.064
Arm and wrist fatigue	2.6	(1.3)	2.8	(1.1)	0.22 (-0.03,0.46)	0.084
Leg fatigue	2.5	(1.3)	2.7	(1.1)	0.20 (-0.04,0.50)	0.106
Self-rated physical work ability	2.8	(0.9)	2.7	(1.0)	-0.16 (-0.35,0.03)	0.089
Beliefs and attitudes						
The food quality is good	3.5	(0.6)	3.8	(0.4)	0.25 (0.13,0.26)	<0.001
Motivation to work	3.1	(0.9)	3.3	(0.8)	0.22 (0.05,0.40)	0.012
Kitchen user recognition	3.4	(0.6)	3.4	(0.7)	0.02 (-0.11,0.14)	0.811
Nutritional guideline application	2.7	(1.1)	3.3	(0.8)	0.56 (0.36,0.77)	<0.001
Food flavouring before serving	3.7	(0.5)	3.7	(0.5)	0.07 (-0.04,0.17)	0.230

^aPsychological parameters included two items per parameter whereas physical and emotional parameters only included one item. Items were scored from 0-4 where high scores in all parameters indicate beneficial/positive development.

^bUnpaired, 2-sided t-test.

4.3.2 Paired analysis

Compared to the unpaired analysis, the paired analysis showed similar results with no significant differences in measured psychological wellbeing between baseline and follow-up. For the parameters influence and recognition, however, a borderline significant increase in scores was identified at $p=0.04$ with a difference in mean (95% CI) of -0.33 ($-0.63, -0.02$) and $p=0.03$ with a difference in mean of -0.29 ($-0.56, -0.03$) respectively (Table 4.5). The significant difference detected between scores at baseline and follow-up for the general body fatigue parameter was no longer identified in terms of physical wellbeing, but a significant negative difference for self-rated workability was ($p=0.01$) (Table 4.5). For the parameters measuring beliefs and attitude, the differences identified for perceived food quality remained significant ($p=0.01$) with a difference in mean (95% CI) of 0.14 ($0.04, 0.24$) (Table 4.5).

Table 4.5 Changes in parameters on psychological and physical wellbeing at work and beliefs and attitudes amongst kitchen workers during organic food conversion (paired measurements, n=92).

Scales	Baseline		Follow-up		Difference	P-value
	Mean	SD	Mean	SD	Mean (95%CI)	T-test ^b
Psychological^a						
<i>Demands at work</i>						
Quantitative demands	3.9	(0.8)	4.0	(0.8)	0.14 (-0.07,0.35)	0.184
Work pace	3.1	(1.3)	2.9	(1.5)	-0.13 (-0.38,0.12)	0.310
Emotional demands	5.0	(1.5)	4.8	(1.6)	-0.17 (-0.44,0.10)	0.205
<i>Organisation and content</i>						
Influence	5.8	(1.8)	5.4	(1.8)	-0.33 (-0.63,-0.02)	0.039
Possibilities for development	5.9	(1.3)	6.0	(1.3)	0.05 (-0.19,0.29)	0.649
Meaning of work	6.7	(1.1)	6.7	(1.1)	0.05 (-0.15,0.25)	0.586
Commitment to the workplace	5.6	(1.4)	5.6	(1.6)	-0.05 (-0.33,0.23)	0.699
<i>Cooperation and management</i>						
Predictability	5.0	(1.4)	4.9	(1.6)	-0.12 (-0.39,0.15)	0.374
Rewards (recognition)	5.8	(1.4)	5.5	(1.6)	-0.29 (-0.56,-0.03)	0.030
Role clarity	6.0	(1.1)	5.8	(1.6)	-0.20 (-0.51,0.11)	0.214
<i>Values at the workplace</i>						
Trust regarding management	5.9	(1.3)	5.7	(1.5)	-0.26 (-0.57,0.05)	0.103
Justice and respect	5.2	(1.3)	5.0	(1.5)	-0.24 (-0.56,0.08)	0.139
Physical						
Body fatigue (general)	2.3	(0.9)	2.3	(1.0)	0.04 (-0.13,0.22)	0.625
Back fatigue	2.6	(1.0)	2.6	(1.1)	-0.03 (-0.23,0.17)	0.750
Neck and shoulder fatigue	2.5	(1.0)	2.4	(1.1)	-0.03 (-0.24,0.18)	0.758
Arm and wrist fatigue	2.7	(1.0)	2.8	(1.2)	0.03 (-0.20,0.26)	0.780
Leg fatigue	2.5	(1.1)	2.6	(1.1)	0.11 (-0.08,0.30)	0.247
Self-rated physical work ability	2.8	(0.9)	2.6	(1.1)	-0.24 (-0.42,-0.06)	0.010
Beliefs and attitudes						
The food quality is good	3.6	(0.5)	3.8	(0.4)	0.14 (0.04,0.24)	0.006
Motivation to work	3.5	(0.6)	3.4	(0.6)	0.20 (0.04,0.36)	0.017
Kitchen user recognition	3.5	(0.6)	3.3	(0.7)	-0.14 (-0.28,0.01)	0.064
Nutritional guideline application	3.2	(0.9)	3.2	(0.9)	0.05 (-0.13,0.24)	0.567
Food flavouring before serving	3.8	(0.4)	3.7	(0.5)	-0.08 (-0.18,0.03)	0.163

^aPsychological parameters included two items per parameter whereas physical and emotional parameters only included one item. Items were scored from 0-4 where high scores in all parameters indicate beneficial/positive development.

^bPaired, 2-sided t-test.

5. Discussion

The research focus of this PhD project included two areas of effect measurements during organic food conversion projects in public kitchens, the organic food percentage and kitchen worker wellbeing. The results presented indicate overall changes in both areas with a significant increase in organic food percentage and both potential positive and negative findings of kitchen workers' wellbeing.

5.1 Results of the PhD project

5.1.1 Baseline evaluation

Almost 75% of the 345 participating public kitchens applied the Organic Cuisine Label method, which is considered the most valid measurement method available, in their baseline assessment of the organic food percentage. According to the measurement comparison study, the percentage interval representing the highest level of measurement divergence was between 55-75%, measured by the Dogme method. Of the baseline measurements calculated by the Dogme method, 4% were placed within this interval and the measurements were therefore accepted as valid. At follow-up, an increased number of public kitchens were predicted to be measuring organic food percentages within the interval 55-75% and therefore the Organic Cuisine Label method was strongly recommended.

More than half of the participating public kitchens in the baseline evaluation were of the type childcare. This kitchen type not only included the highest number of public kitchens but also documented the overall highest level of organic food percentage at baseline. Approximately half of the childcare kitchens documented an organic procurement of 60% or higher and only 22% of the participating public kitchens did not qualify for any of the three Organic Cuisine Labels, illustrating a higher level of organic procurement than all other kitchen types at baseline. This can probably to a large extent be explained by the long history of organic food conversion this type of public kitchen has experienced, especially in the Copenhagen area^(124,125,153).

Also elderly public kitchens documented a relatively high baseline level of organic food procurement (33%) with only approximately half of the participating kitchens not qualifying for a label at baseline, which again might be explained by the focus these public kitchens have experienced over the last decade regarding organic food conversion^(120,125). It is likely that these two kitchen types may have been focused on in conversion projects in the past due to their vulnerable target groups and potentially also because their food production systems have

allowed for organic conversion to greater extent than the production systems in hospitals and residential institutions^(125,132). Considering this history of organic conversion, it could be argued that the relatively high level of organic procurement identified in the baseline evaluation for childcare and elderly care kitchens would be a positive starting point. Public kitchens with an organic food percentage between 30-60% and 60-90% may need further assistance in conversion to advance even more. However, in the present study 17% of the childcare kitchens had an organic food percentage between 90-100% when included in the study. Their potential for increasing their organic percentage is therefore likely to be much less than other kitchen types such as the central kitchens, residential institutions, canteens and hospitals that all had baseline organic percentages below 15% or at 16%.

These latter types of public kitchen can generally be characterised by a more complex food production system compared to childcare kitchens and by having several obligations to tend to regarding kitchen user requirements^(111,132). It is therefore likely that the kitchens classified as central kitchens, residential institutions, canteens and hospitals would need other or extra efforts to obtain a high organic percentage during a conversion process.

5.1.2 Effect on the organic food percentage

The organic food percentage of the participating public kitchens increased significantly with a median difference of 24 percent point. The only kitchen type that experienced a non-significant increase was the afterschool kitchens that were relatively few in numbers and with a large variation in organic food percentage at baseline. At kitchen level, this effect equals an upgrading by almost one label (30% intervals) according to the Organic Cuisine Label after completing an organic food conversion project.

Overall, these results of organic food procurement in specific public kitchen types add valuable new knowledge to the field. The childcare kitchens remained the public kitchen type with the highest organic food percentage at baseline and follow-up and so, these kitchens were able to increase their organic food percentage even further despite starting at a high baseline level. In the present study, the central kitchens, residential institutions, the canteens and the elderly kitchen types increased their organic food percentage the most (with a median difference above 34-39%). Hospitals did not increase as much in comparison, and this could be an illustration of the challenges these public kitchens face regarding patient procurement where changes to menus and food systems may be more complicated⁽¹³²⁾.

The results obtained could reflect the structural differences between the different public kitchen types in terms of background characteristics, potentially affecting the conversion process within the public kitchens. Childcare kitchens had already been introduced to the process of organic

food conversion over the years and this experience may explain their high baseline level and relatively lower change at follow-up. The smaller size of childcare kitchens relative to central kitchens and hospitals can also be a part of the explanation⁽¹³²⁾. Structural differences may also relate to the number of meals served and opening hours for production, where childcare, schools, afterschool and canteens do not serve all meals throughout the day and therefore, the responsibility of achieving a complete nutritionally balanced diet is not solely placed within the public kitchens.

Oppositely, central kitchens, hospitals, residential institutions and some elderly care kitchens have the responsibility of procuring the full diet, seven days per week. This could potentially challenge the conversion process by requiring extra investments to ensure the optimum energy and nutrient balance is reached for each kitchen user^(111,132). Likewise, whether kitchen users pay for the meals upfront as is common practice in canteens and cafés might also affect the implementation of organic food production by introducing market conditions and hence, the kitchens have to consider price-ranges, kitchen users' willingness to pay and product quality in different ways compared to childcare and elderly care public kitchens⁽¹²¹⁾. Also, residential institutions and afterschool care kitchens may have been challenged by the mixed functions they perform in which social care services offered may be interlinked with food preparation. For the same reason, employees often play roles of both pedagogues and kitchen workers simultaneously, adding a certain level of complexity to an organic conversion. All of these structural differences were important reasons as to why categorisations of public kitchen types could be required in order to better understand the varying processes experienced by the different kitchen types during organic food conversion, rather than comparing organic food percentages across kitchen types. Interestingly though, as the results indicate that almost all public kitchen types significantly increased in organic food percentage, it seems possible to implement organic public procurement regardless of kitchen type.

Conversion project curriculum components

The mapping of the conversion project curriculum components contributed with valuable insights into the extensive process the public kitchens participate in. Nine of the 12 components (Table 4.3) were specifically described in either all nine or eight conversion projects, which seems to suggest a general agreement among projects of the importance of these components.

The results from the mapping of curriculum components might also be important in terms of indicating other effect areas. This PhD project was limited to organic food percentage measurements and wellbeing among kitchen workers but with the included conversion projects highly agreeing on curriculum components such as "Menu-planning", "Practical cooking classes", "Nutritional guidelines", "Budgeting" and "Food-waste lessons", it seems effects within

these topics could very well be expected. As already mentioned, no casual links or associations could be established from these results but as a significant increase in organic public procurement was found following the implementation of nine conversion projects, in which particularly nine curriculum components were emphasised, it seems likely that these nine components have been successfully implemented. Especially when bearing in mind, that no funding from the Danish Organic Action Plan 2020 has been available to cover any additional expenditures to the food budget that the public kitchens might face when increasing the proportion of organic food products in the procurement.

These other effect areas have been discussed in the literature for several years^(15,111,119,121,144) and recently food waste has been explored with specific measurements⁽¹⁶²⁾ but apart from that, not many specific measurements have been conducted to confirm or reject changes in these areas. Maybe results from this PhD, measuring a change in organic food percentage combined with the mapped curriculum components, could be used as a base for future research in these effect areas of organic food conversion. As outlined in the introduction, the conversion project process has been studied and described before^(111,132) but the curriculum components identified in the present conversion projects may have indicated a few additions to this process.

New elements in organic conversion: the Organic Cuisine Label method and networking

One of the new features in the conversion projects was the introduction of the Organic Cuisine Label method. The application of the Organic Cuisine Label method for organic food percentage registration was an official specification within the grants from the Danish Organic Action Plan 2020. This was the first time this measurement method has been a required component within the conversion projects, and therefore a new feature to be integrated in the conversion process. Interruptions related to introducing new methods can be expected and this also happened during the introduction of the Organic Cuisine Label method, either because public kitchens had no experience with organic food percentage measurements at all or because they were familiar with the Dogme method instead.

This challenge seems to have been considered by the conversion projects as they all included the curriculum component “Organic Cuisine Label method introduction and application”, showing that kitchen workers were supposed to be trained in applying the method in practical terms during the conversion process. Any potential issues with applying the Organic Cuisine Label method in public kitchens might relate to basic practical barriers such as computer access and IT skills of the kitchen workers. Attention to practical knowledge skills such as these could be relevant for future conversion projects but also generally for any kitchen management and local authority who wish to promote the application of the Organic Cuisine Label in public kitchens.

Initial difficulties in applying the Organic Cuisine Label method might also have been due to challenges at a higher level regarding supplier cooperation and food deliveries as observed previously⁽¹¹¹⁾. The invoices needed for the Excel calculation sheet in the Organic Cuisine Label method can vary in terms of the level of procurement detail provided and availability in terms of frequency of provision, which can affect the ability of the public kitchens to deliver the necessary documentation required by the Organic Cuisine Label method⁽¹¹³⁾.

To solve these issues, procurement agreements and collaborations between all actors involved in the public procurement have been emphasised to anchor and further develop the Organic Cuisine Label method⁽¹³⁷⁾. Good communication between kitchens and suppliers regarding specific kitchen procurement needs and wishes as well as support from decision-makers to establish contact with local suppliers has also been highlighted before as possible improvements to the conversion process and application of the Organic Cuisine Label⁽¹³⁷⁾. In light of the curriculum components mapped, it seems that organic food conversion managers have attempted to embrace these recommendations by including the component of “Network between/among kitchens, suppliers and producers”, indicating that the projects facilitated fora for networking among the actors to improve communication.

The two components on “Organic Cuisine Label method introduction and application” and “Network between/among kitchens, suppliers and producers” may play important roles in terms of anchoring the increased organic procurement achieved during the conversion process, also after the conversion projects have ended. Applying the Organic Cuisine Label method and achieving a label has been shown to motivate public kitchens in the conversion process and inspire them to continuously increase and sustain a high level of organic procurement, not least because their achievements can become more publicly visible and they thereby receive more acknowledgement for them⁽¹¹⁶⁾.

The fact that the conversion projects in this study included public kitchen training on applying the Organic Cuisine Label method may therefore raise expectations of the measured effect in this study of increased organic procurement being a sustainable one. Similarly, the component on network included in all conversion projects in this study indicates that public kitchens were introduced to their suppliers and producers face-to-face and create useful connections in terms of developing their procurement further. The intention being that these connections should be maintained after the conversion projects have finished. This again could help public kitchens sustain the organic procurement level achieved as well as improve their understanding of future possibilities in terms of their procurement.

Components related to sustainability

All nine conversion projects included the component “Menu-planning with new production systems” and eight of the nine conversion projects included “Practical cooking classes (local and seasonal)”, “Food-waste lessons on re-use of leftovers” and “Budgeting for more organic food within previous budget”. The themes of these components were in line with previous descriptions of the organic food conversion process in public kitchens, in which changes to the public kitchen food production systems have been reported^(132,144,145). These components and changes can be considered essential to the conversion process as they potentially optimise kitchen production and lower expenditures in different areas. Hence, the additional cost of organic food procurement might be covered by food-waste reductions along the production process, menu-planning to include more fruit and vegetables rather than meat products and applying local and seasonal products^(111,145).

When no funding has been made available in a conversion process to expand the public kitchen food budget in order to substitute conventional food products with organic version, the conversion process becomes dependent on the possibility of streamlining the public kitchen food production system. Public kitchens that may already have been through budget-cuts and therefore already have been evaluating their menu-plans and food-waste might not be able to achieve as high an organic food percentage as kitchens who have not yet been streamlined. Most public kitchens seemed to be able to change routines in a way that allowed for a certain level of organic food procurement, but this could depend on the number of changes the kitchen has already faced along with the level of support gained from kitchen workers, managers and local decision-makers. Nonetheless, the curriculum components mentioned above indicate that effects of the conversion projects probably include improvements to sustainability and the environment.

Analysing the curriculum components of the conversion projects are important steps, suggesting that a holistic approach to organic public procurement has been implemented in the present conversion program. The increased political focus on organic public procurement from initiatives such as the Danish Organic Action Plan 2020 along with the promotion of the Organic Cuisine Label method could otherwise pose conflicts in terms of consequences to sustainability. This is seen as the Organic Cuisine Label does not include considerations of food packaging, processing, seasonality or local food production and sourcing which are important aspects of sustainability in terms of environmental costs of transportation and production^(188–190). In itself, the concept of acquiring acknowledgement through the Organic Cuisine Label solely by procuring a sufficiently large proportion of organic food products leaves little incentive for kitchens to consider any other food qualities.

Hence, organic public procurement may not necessarily improve environmental sustainability if the food products procured have been transported over long geographical distances and are highly processed. For future conversion projects, sustainability measures similar to the indications of the identified components mentioned above could be recommended. Possibilities for future improvements to support public kitchens in increasing organic public procurement without undermining sustainability could include implementing measures that increase the level of flexibility in procurement agreements^(137,147). This topic may however involve potential conflicts with international trade agreements, complicating the scenario further but alternative options to enable public kitchens to choose local producers and suppliers should be developed upon⁽¹⁴⁷⁾. This would also meet requests by public kitchens expressed earlier⁽¹³⁷⁾.

Components related to nutrition

The “Nutritional guidelines relevant for kitchen users” component included in almost all conversion projects also represented an important aspect of organic food conversion. While increasing the organic food percentage and implementing menu-changes to include more plant-based seasonal and local food products, public kitchens are also made responsible for procuring healthy meals appropriate for their target group. To increase the organic food percentage, public kitchens were trained to reformulate recipes, including replacing expensive meat ingredients with cheaper vegetable, grains, legumes and fish, which have been found to result in healthier diet composition in public kitchen types serving one meal per day^(163,164). But the public kitchens completing conversion projects in this study catered for basically all age segments of the Danish population including preschool-children, school-children, adults, elderly and patients all of which have had different nutritional requirements for the public kitchens to consider^(150,151,165). Appropriate nutrition is crucial. Elderly people and hospitalised patients with poor appetite have a requirement for diets rich in energy and protein and therefore pose a special concern. Indisputably, the public kitchen type plays a role in terms of appropriate nutrition, especially depending on whether the kitchen serves one main meal per day or a complete nutritionally balanced diet. The inclusion of the “Nutritional guideline” component in the majority of the conversion projects indicate that also the challenge of appropriate nutrition was included in the conversion project content.

This argument could be supported by the results from the kitchen worker wellbeing study, where kitchen workers reported a significant increase in the application of nutritional guidelines following organic food conversion. The present study suggested that the organic food conversion projects have resulted in increased application of nutritional guidelines in the participating public kitchens and/or increased awareness of the application of nutritional guidelines among kitchen workers, either of which indicating potential positive effects on healthier public procurement.

5.1.3 Kitchen worker wellbeing

The present study found no significant differences in experienced psychological wellbeing and only small differences in physical wellbeing before and after the completion of a conversion project. Regarding the measured changes to kitchen worker beliefs and attitudes before and after organic conversion, these indicated improvements to perceived food quality, motivation to work and application of nutritional guidelines. The measured effects in kitchen worker beliefs and attitude were supported by the expressed kitchen worker opinions at follow-up, which were directly linked to the implemented conversion process and showed high proportions of kitchen workers reporting a positive/very positive effect of the conversion process on their job satisfaction, joy with work and motivation to work at follow-up. This is the first study presenting findings from a longitudinal quantitative questionnaire study, measuring changes in wellbeing at work among public kitchen workers during an organic food conversion. By including parameters on both general psychological and physical wellbeing along with beliefs and attitudes and opinions specific to organic food conversion, this study covered several areas within wellbeing in a holistic approach in order to detect potential changes in a broad area.

The results showed no significant changes to psychological wellbeing among kitchen workers, one significant change of six parameters measuring physical wellbeing and three significant changes of four parameters measuring beliefs and attitudes among kitchen workers at follow-up. The questions on job satisfaction, joy, motivation and workload that were added at follow-up were not measured at baseline and so did not indicate an effect. However, they did correspond well with the positive development measured in kitchen worker beliefs and attitude for the unpaired analysis especially but also for the paired analysis. Interpretations of these results could suggest that either no additional work demands were introduced as a consequence of the implemented organic food conversion or that any potential additional work demands experienced by the workers in relation to the implementation of organic food conversion might have been balanced by the professional skills training gained during the conversion projects. This interpretation of the results would also be in agreement with previous analysis from organic conversion projects, which found increased capacity building, motivation, commitment and status following the implementation of organic food conversion⁽¹¹¹⁾.

The parameters measured with respect to the psychological and physical wellbeing at work were chosen based on their ability to measure general wellbeing in terms of respect, trust, influence, predictability, and fatigue in legs, arms and wrists. It may require interventions over a longer period before significant effects in these parameters would be measured, where attitudes and opinions might be affected more within a shorter time period. Parameters of psychological and physical wellbeing would therefore be important to observe continuously to prevent negative impacts in the long-term. The questions asked to measure beliefs and attitudes of the

kitchen workers were more related to the kitchen environment, for instance in terms of food quality, flavouring and application of nutritional guidelines. These questions may have been simpler to answer in relation to the procurement profession compared to questions on experienced emotions and feelings. The experienced psychological wellbeing at least might easily be affected by many other factors outside the public kitchen working environment as well and any experienced affects to these parameters might not have been linked to wellbeing at work and therefore not been expressed during the questionnaire study.

In terms of the physical wellbeing measurements, a few differences were identified between paired and unpaired analyses. Significant findings identified in relation to general body fatigue and self-rated workability differed between analyses, suggesting that the differences may be related to kitchen dependent working environments. For instance, the physical facilities differ with some but not all kitchens being able to adjust and improve physical working areas within the kitchen according to the potential additional needs of the kitchen workers. The results could also demonstrate how motivated kitchen workers noticed potentially increased physical workloads less or oppositely, how additional work demands decreased perceived work ability.

The results from the four follow-up questions on job satisfaction, joy with work, motivation and work load indicated a positive direction of opinions. Unlike the parameters measuring psychological and physical wellbeing, these questions were designed to measure opinions directly linked to the conversion process and so, even if the questions cannot be used to suggest an effect, the results illustrated a clear and positive trend among the kitchen workers.

The importance of kitchen worker involvement for successful implementation of organic food conversion has been stressed^(111,123). Hence, the curriculum components aiming to develop the professional competencies of the kitchen workers and increase motivation were important aspects of the conversion projects, recognising the fact that successful implementation to a great extent depended on the level of knowledge of organic food among kitchen workers and their motivation to prioritise it. Kitchen worker motivation towards organic food procurement was not only important in terms of initial implementation of organic conversion but also concerning maintaining organic procurement in the long-term. The identification of these components in the conversion projects could therefore be considered a sign of quality in terms of consistent organic public procurement. Since preparing meals from base rather than buying ready-made products could result in substantial savings the food budgets within public kitchens, the more of the procurement the kitchen workers were able to produce themselves, the higher organic food percentage could be achieved⁽¹³⁷⁾. Hence, improving the professional skills among kitchen workers may have empowered them and thereby improved experienced wellbeing as well as increased the potential for a high level of persistent organic public procurement.

Regarding previous experiences with kitchen worker wellbeing during an organic food conversion, qualitative interviews with kitchen workers from elderly care kitchens revealed how the public kitchen workers wished to produce good quality food from base rather than using convenience products and that modernised public kitchen food production systems with cook-chill and re-heating of food decreased their motivation⁽¹²⁰⁾. The opinions could have been the same among workers in public kitchens today where food production might still have focused on convenience products. At least the findings from this study complimented the past experiences by suggesting increased satisfaction, motivation and joy with work following organic conversion, in which food production from base have been an integrated component.

Results from this study are also supported by findings from former mixed-method studies reporting increased job satisfaction and motivation to work following stress moderation and job-control among service and catering staff^(158,159). A longitudinal study from England on the impact of implementing a whole school food programme on kitchen staff employment also suggested that, gaining new knowledge and skills resulted in increased motivation and involvement experienced by kitchen staff⁽¹⁶⁰⁾. Research on the role of job-control and support from management among service-workers also found that these may provide a buffering effect against increased job demands to protect psychological wellbeing⁽¹⁵⁹⁾. These studies indicate that public kitchen worker wellbeing could depend on similar variables across countries and so, the findings from this study potentially carried a certain level of transferability should organic food conversion be implemented in other countries.

The findings from the present study suggest that organic food conversion in public kitchens can be implemented without adverse effects on experienced wellbeing at work among kitchen workers. Although, the effects on physical wellbeing observed might indicate a certain level of attrition among kitchen workers in the long-term, which should be considered in future conversion projects.

5.2 Reflections on the project development

The overall research setting was set by the launch of the Danish Organic Action Plan 2020 through which funding for implementing organic food conversion projects was made available. This initiative was the important catalyser for this PhD project but at the same time posed restrictions to possibilities in terms of design, methodology and analysis. Generally, the Danish Organic Action Plan 2020 provided a strong structure within a real-life setting because of the professional implementation of organic food conversion, potential for large-scale study populations and a relatively long and fixed time-frame to conduct research. However, as

mentioned in the preconditions and assumptions of this project, these advantages posed limitations to research at the same time. The research planning was for instance dependent on the fixed time-frame set by the Danish Organic Action Plan 2020 for receiving funding, which indirectly dictated the deadlines for baseline and follow-up measurements along with possible length of the longitudinal studies. Also as mentioned, the number of conversion projects, their intervention content along with the number of included public kitchens and their characteristics were preconditioned to the project planning.

The intentions behind this PhD project were to accommodate these preconditions by strengthening the study design where otherwise possible. Measuring effects to several areas with scientific measurement tools was one original plan to open the possibility for a certain level of triangulation across and between areas and thereby strengthening the research design. Whilst reviewing the literature, several areas were also found to be relevant to include, especially effect measurements to the organic food percentage, kitchen worker wellbeing, nutritional aspects of procurement and food preparation were highlighted and additionally, these areas were initially all within the scope of the research project.

Another aspect of the original research plan was the inclusion of an appropriate control group. Once the granted conversion projects and public kitchens had been identified, a control group of public kitchens outside the Danish Organic Action Plan 2020 with no experience of organic food conversion were to be recruited. This recruitment was expected to be resource demanding as public kitchens would have to match the participating population sample as much as possible regarding kitchen type, size, location and food production system but have no or little experience with organic conversion, which would be a challenge considering the history of organic food conversion in public kitchens in Denmark and especially in greater Copenhagen.

However, these research plans were affected by external factors arising from a combination of the preconditions and the real-life research setting. During the baseline measurements, external challenges and delays necessitated further narrowing of the research agenda in which priority was given to the two crucial effect areas, organic food percentage and kitchen worker wellbeing.

5.2.1 Organic food percentage measurements

Measuring the effect of organic food conversion on the organic food percentage in the public kitchens has not been documented to this extent before and these measurements were fundamental in terms of determining associations with any other potential effects. The Organic Cuisine Label method can be viewed as a more accurate measurement method of the organic food percentage and the application of this method was also supported by the Danish Organic Action Plan 2020. Relying on procurement invoices from public kitchen suppliers, the method

objectively measured the proportion of organic food procured by the kitchen unaffected by the type and size of the kitchen, which increased the validity and reliability of the method. The Organic Cuisine Label method was therefore considered the most appropriate measurement method for this project. However, the method was developed in 2009 and in 2012 when this research was initiated, few public kitchens or conversion managers were confident in applying this method. Especially public kitchens with challenging structures in terms of food supply and production systems such as certain childcare and elderly care kitchens, schools, afterschool kitchens and residential institutions also remained dependent on the Dogme method.

To be able to apply the Organic Cuisine Label method, these kitchens needed changes to their supply and procurement systems as well as training in method application which would not be possible in time for the first baseline measurements. In order to ensure that all participating public kitchens would be included in this study with scientifically acceptable baseline measurements, a comparison study of measurements by the Organic Cuisine Label method and the Dogme method was initiated. As the application of the Dogme method would only be necessary in a limited number of public kitchens and only at baseline, investigating the extent of potential differences between the two methods at percentage levels relevant at baseline would justify the inclusion of all participating public kitchen so long as measurement disagreements were acceptable.

Public kitchen types included in the comparison study were childcare and elderly care kitchens in order to focus on the kitchen types representing the majority of the included kitchens in the conversion projects. A higher number of enrolled public kitchens would have been warranted from a scientific point of view but an extension was not possible due to time and budget limitations. Ideally, the baseline measurements should have included a larger sample of public kitchens representative of the entire study sample from the conversion projects if not the general population of public kitchens in Denmark. A larger sample size would also have improved the representativeness of each percentage level of this study and thereby increased the possibility of observing disagreements between the methods at different percentage intervals. For the comparison study, data analysis included a Spearman correlation, accounting for non-normally distributed data. However, high correlation does not necessarily imply good agreement between methods. A more valid assessment of agreement is provided by a Bland-Altman plot of the differences between the methods against the mean values⁽¹⁸⁴⁾. Used in combination, these two methods identified systematic disagreements between organic food percentage measurements by the two methods. Both median and mean values were calculated and reported, showing that the difference between baseline and follow-up measurements in organic food percentages was found to be almost the same either way.

Following the start-up problems in terms of initial baseline measurements by the Organic Cuisine Label, close to all public kitchens were able to apply this method for the remaining measurements. Further, to evaluate the overall effect on organic food percentage, all public kitchens participating in conversion projects covered by the research time-frame were included. Public kitchens from conversion projects initiated in fall 2012 and spring 2013 and were completed by summer 2015 were therefore included. This was done in an effort to increase the sample size and thereby power as much as possible.

Mapping of curriculum components

The mapping of curriculum components of the funded conversion projects was an aspect introduced in connection with organic food percentage measurements. This aspect was introduced as a secondary feature to bring knowledge on common best-practice elements implemented across conversion projects. To conduct the mapping of components within the scope of this project, the official project descriptions available from the Danish Organic Action Plan 2020 were used to identify the educational content of all conversion projects. This educational content was then arranged in components according to themes presented in previous research^(111,132) and according to interviews with conversion managers.

With more time and budget resources, it would have been preferred to include a control group as well as elaborated conversion project descriptions. This could have been done by performing extensive face-to-face interviews with all relevant conversion managers on the design of their conversion strategies along with interviews with representative samples of public kitchen workers from each conversion project. This could have provided valuable information regarding actual implemented conversion project content and potentially indicated any discrepancies in terms of intentions by conversion projects and experienced intervention education, enabling a certain level of triangulation in terms of project content.

Comparisons with a control group and conversion project content from all conversion projects gathered from qualitative interview studies would have improved the possibilities for associating effects on the organic food percentage to conversion project implementation in general, and also for associating specific project components with higher percentage levels achieved. Associations of this extent would require further research. However, the mapping of curriculum components included in this study has provided more knowledge on the implemented conversion projects with respect to similarities and differences, which could be valuable aspects in combination to the measured effect on organic food percentages.

5.2.2 Kitchen worker wellbeing effect measurements

The wellbeing of public kitchen workers during an organic food conversion had been explored qualitatively before this study but no quantitative measurements of effects had been published. Previous research agreed nonetheless, that this area was one of the most determining factors of overall working environment as well as initial success of organic conversion implementation and the sustainability of organic conversion in the long-term^(111,120,123,132), justifying priority to this research area. In light of the large sample-size potential from public kitchens in connection to the Danish Organic Action Plan 2020 as well as the lack of quantitative research results identified during the literature review, a questionnaire study seemed suitable and realistic for the purpose of the project. Since no questionnaires targeted public kitchen workers during organic conversion had been published prior to this study, one was developed for the purpose.

The questionnaire developed was intended to measure general psychological and physical wellbeing at work among public kitchen employees before and after organic conversion. One existing questionnaire on psychological wellbeing at work was the COPSOQ which has been validated continuously both in Denmark and internationally^(175,177,178,180). The COPSOQ II has been tested in a study sample of 3.517 respondents from Denmark where each item from each parameter was analysed for internal consistency reliability by Cronbach's alpha along with floor and ceiling effects, all items showing a high Cronbach's alpha of above 0.7⁽¹⁷⁵⁾. The COPSOQ II is available in three versions, the longest including 41 parameters and 128 questions and the shortest version including 23 parameters and 40 questions. In order to keep the length of the questionnaire as brief as possible, the shortest version was selected for this study. Further, following expert guidance on questionnaire construction in public kitchen worker research, the number of parameters was further limited to include only the most important.

The COPSOQ was complemented by parameters on physical wellbeing at work from the national cohort by NRCWE, which have been developed and validated upon since 1990^(176,181). Parameters and questions applied in the questionnaire for this study on general psychological and physical wellbeing could therefore be considered strong in terms of validity and reliability. Another section on kitchen worker beliefs and attitudes was added as well in order to gain knowledge the workers' opinion on issues more specific to public kitchen field rather than only focusing on the general working environment. Though these parameters were not validated to the same extent as the other two questionnaires, the questions were pilot-tested in the present study in seven public kitchens to improve the understanding of them by users. These parameters were important to include, tailoring the questionnaire to the profession of public procurement. Also the four questions added at follow-up were important as these provided indications of kitchen worker opinions specifically related to the organic food conversion

implemented. The scientific validity of these questions was not as strong but their value alongside the measurements of general wellbeing at work was considered to be important.

Generally when altering questionnaires from the form they were originally validated in, their strength of the validity may be compromised. This was also the case during this development as parameters have been selected from the established wellbeing at work questionnaires to shorten the length of this questionnaire and so, questionnaire length and level of validity could be considered a matter of balance. The questionnaire was constructed carefully following expert guidance in order to increase the scientific quality, including as much relevant information as possible while keeping the questionnaire short. Ideally, a quantitative questionnaire design of this sort would have been validated extensively in its final version before implementation. For the purpose of the research question, this questionnaire could also have been complimented by other methods such as qualitative interviews with kitchen workers to strengthen scientific validity and reliability of the results.

As many kitchen workers from the conversion projects as possible were sought to participate in this questionnaire study. However, the initial project changes had caused delays to the development of this questionnaire as well and so only public kitchens and workers from conversion projects receiving funding in spring 2013 were eligible for inclusion. This meant that 170 public kitchens and 448 kitchen workers were included, which could still be considered an acceptable sample size but not as large as if all 622 participating public kitchens could have been included. Statistical analysis of experienced kitchen worker wellbeing for public kitchens within each conversion project would have been particularly interesting to compare with the overall effect of these conversion projects on the organic food percentage and curriculum components as well. The total number of responses at baseline ($n=235$) and follow-up ($n=149$) were fewer than predicted and as the paired measurements ($n=92$) were even fewer, it was decided to base the main analysis on as many responses as possible to increase power, yet including paired measurements for a second analysis to compare.

With more time for method development and recruitment, it would have been interesting to include all public kitchens from each participating conversion project to conduct stronger cluster analyses between projects and maybe also between kitchen types. Though great efforts were made during recruitment, a higher number of participants at baseline and limiting the loss to follow-up should be considered in the future. Increased number of responses combined with qualitative interviews with kitchen workers from each conversion project and from different kitchen types might have represented sufficiently strong results to suggest best-practice recommendations for the future in terms organic conversion and improved kitchen worker wellbeing.

5.3 Strengths and limitations

Important strengths associated with this PhD project include the application of the Organic Cuisine Label method. This method has never been applied in research at this level before and these results therefore contribute with new knowledge and stronger scientific measurements in this area. Adding the comparison study of measurements by the Organic Cuisine Label method and the Dogme method also improve the validity of the baseline measurements. However, a number of limitations also need to be mentioned to interpret the results appropriately.

Overall limitations include the lack of a control group, a randomised design and representative samples of public kitchens. In order to infer causality, an appropriate control group of public kitchens should have been recruited outside the action plan structure both in relation to the effect measurements of organic food percentage and kitchen worker wellbeing. Due to the high level of experience over several years with organic food conversion, appropriately matching controls would have required a lot of resources to recruit. Even if a control group was not possible to include, stronger efforts to describe the participating conversion projects might have improved the possibility of comparing them, using each other as controls.

Setting specific preconditions related to the Danish Organic Action Plan 2020 also introduced limitations in terms of representativeness and generalisability of the population samples and so, selection bias could not be excluded. The time-frame for this PhD project was also a preconditioned limitation, meaning that the observed effects of organic food conversion projects on the organic food percentage and wellbeing at work represented results over a relatively short period of time and it was therefore not possible to conclude on the longer-term sustainability of the organic food procurement level achieved in this study.

During the comparison study of organic food percentage measurements by the Organic Cuisine Label method the Dogme method, the sample size was limited and ideally representative samples for all eight kitchen types should have been included to compare the methods across different kitchen structures. The participating public kitchens in the comparison study were not representative for all public kitchens in Denmark and results were not generalizable, which was also the case for the effect measurements of organic food percentage. However, from the point of view of this PhD project, all possible public kitchens and workers selected by the conversion projects were attempted reached and further selection avoided. In relation to measuring the effect on organic procurement, the quality of the results was strengthened by the relatively large public kitchen sample size. The long history of organic food conversion in Denmark may also compromise generalizability of the results as well as potential transferability to other settings. During the mapping of the curriculum components, project descriptions of the conversion projects from the application stage were applied and these may not have been updated in terms

of the specific project content implemented. Moderation of this limitation was attempted through discussions with the conversion managers to correct for main discrepancies.

In terms of measuring wellbeing among kitchen workers the sample size was relatively small, again resulting in restricted representativeness and generalisability. Also the risk of introducing loss to follow-up with a 63% response rate of those surveyed at baseline as well as response bias cannot be excluded due to the self-administered questionnaire design. The data collecting process should furthermore see improvements regarding the on-line questionnaire by fully integrating the question of gender and eliminate unknown gender specifications. To base the questionnaire design on well-established questionnaires^(135,175,176) in combination with author-constructed sections has been seen before⁽¹⁸²⁾ and it could be beneficial in terms of tailoring the questionnaire specifically to the target population. But it may also have compromised the validity and reliability of the questionnaire. With more time, the questionnaire should therefore have been validated more extensively rather than relying on pilot-testing. One strength to this study included how the measured personal characteristics of the participants did not vary significantly from baseline to follow-up and lastly, both paired and unpaired analyses have been included for possible comparisons.

According to the original research plans, effects to nutrition and food processing at procurement level should also have been studied. These topics were excluded due to time and resource restrictions and hence, results in these areas are lacking.

Overall, the analyses from the different study areas correlated well by indicating changes in the same direction, which supported the reliability of the results. The effect area measurements included in this PhD study represented a knowledge-gap in the evidence base during the literature review and these results have contributed with important new knowledge.

5.4 Potential impacts

These results might be used to suggest possible impact directions arising from increases to organic public procurement in Denmark. Increased organic public procurement was found in 622 public kitchens in this study and with 6.000-10.000 public kitchens existing in Denmark, the potential remains high for effects to both organic food percentages and additional side-effects. The question is if the cause-and-effect chain reaction holds true, in which implementing organic food conversion projects contributes to the aim behind the Danish Organic Action Plan 2020 of doubling the Danish organic agricultural area by 2020. There are no legislative measures included in the initiative to ensure that any potential increase in demand of organic food products will be met by local or even national organic food production. In fact, recent Danish

statistics show increasing numbers of both import and export of organic food products⁽¹⁰⁵⁾ and if an increased demand for organic food from Danish public kitchens is met by imported products over national, it can be argued that the market driven encouragement for farmers to convert to organic agriculture in Denmark is lacking. Regarding effects on the environment and sustainability, increased levels of transportation following additional import and export of organic food products may well result in damaging effects, which was not part of the intended effects stated in the plan⁽¹⁰⁹⁾.

In terms of contributions to the CAP reform, the majority of imported organic food products in Denmark originates from Germany and the Netherlands⁽¹⁰⁵⁾. Therefore, any potential increases in the demand of organic food products in Denmark that are not met by national production may well be met by the production within Europe and so potential promotion of organic farming resulting from the Danish Organic Action Plan 2020 would probably remain within the scope of the CAP reform. In the discussion of promoting organic food production for the purpose of international trade, considerations should include whether the stimulated conversion of agricultural land to organic farming provides sufficient amounts of environmental benefits to outweigh the costs introduced by increased levels of transport. Either way, a holistic approach should be applied when evaluating the effects of both the Danish Organic Action Plan 2020 and the CAP reform in relation to sustainability.

The results from this study indicated a focus on several components alongside the implementation of organic public procurement, including local and seasonal products along with food waste reductions. Depending on the role of these elements in practice in the public kitchens, increased organic public procurement in Denmark might indeed increase demand for Danish organic food products, which might then also result in improvements to environmental factors such as animal welfare, food waste, groundwater protection, biodiversity and application of chemical pesticides and fertilisers. However at national level, pesticide application for an example is already tightly regulated even in conventional food production and so, the national impact in this area may not be as significant as it could be in other countries during organic conversions. In terms of human health impact, an important area highlighted in the curriculum components identified in this study might then relate to diet compositions of organically produced meals more in line with current national recommendations^(38,165). This would be relevant for all age segments in the Danish population and the potential would therefore be important to explore.

These areas hold great promises that should be investigated further, especially considering the present need globally to re-evaluate health and sustainability in the food production systems currently in place.

6. Conclusions

Overall, the organic food conversion projects in the Danish Organic Action Plan 2020 resulted in a significant increase in the organic food percentage in the participating public kitchens over a median period of 1.5 years. The organic food percentage measurements obtained by the Organic Cuisine Label method were comparable with those obtained by the Dogme method at procurement levels relevant for baseline measurements. The four curriculum components on “Theory”, “Menu-planning”, “Network” and “Organic Cuisine Label” were included in all conversion projects and may therefore be considered core components.

The organic food conversion projects did not result in significant differences in wellbeing among kitchen workers (n=235) during the conversion period, except for the one of six parameters measuring physical wellbeing. However, significant increases in parameters measuring beliefs and attitudes were observed in terms of motivation to work with organic food production, perceived food quality and nutritional guideline application and these parameters were supported by expressed improvements in joy with work, job satisfaction and motivation by kitchen workers at follow-up. All together, these results indicate that organic food conversion in public kitchens is possible without measurable negative impacts on wellbeing at work in the short-term as long as job-control practices and kitchen worker involvement are considered.

Overall, this PhD study has contributed with new knowledge to the existing scientific evidence base on the effectiveness of organic food conversion projects in terms of increased organic procurement in public kitchens in Denmark. Effects – positive or negative - of the conversion projects on environment, sustainability and human health still deserve to be investigated in-depth. Whether the implementation of organic food conversion projects will fulfil the aim of the Danish Organic Action Plan 2020 of doubling the Danish organic agricultural area by 2020 cannot be concluded from these results but they may well make a significant contribution.

6.1 Perspectives

The results from this PhD study are based on longitudinal measurements with a median follow-up period of 1.5 years. Further research is needed to measure the long-term effect of the Danish Organic Action Plan 2020 and the organic food conversion projects on the organic food percentage in the public kitchens to assess whether the change is sustainable. The curriculum components of the organic food conversion projects were mapped in this study. It would be interesting for future research to add more elaborate investigations in terms of the

implementation strategies and best-practice models in organic food conversion in public kitchens, including the level of transferability to other kitchens and countries. To explore potential effects of organic food conversion in public kitchens on the environment and sustainability as has been discussed above, detailed measurements of food-waste, diet compositions in terms of animal and plant-based products as well as application of seasonal and local food products in public procurement following an organic food conversion process should be conducted. These results will be important in terms of evaluating the true effect of the Danish Organic Action Plan 2020 and similar initiatives on for an example local food product sourcing in public procurement.

Similarly, changes to nutritional quality, food quality, kitchen user satisfaction and diet compositions in public kitchens following an organic food conversion would be relevant to measure in the future to establish possible health effects of organic public procurement. Results from this PhD study suggest an increased application of nutritional guidelines relevant for the kitchen users in the public kitchens following completion of a conversion project, but whether this is the case and if this finding has resulted in beneficial health effects is still unknown and calls for further investigation. Studies on human health effects following organic food conversion in public kitchens would also need to consider changes to both nutrient-related health effects as well as health effects resulting from changes in exposure to non-nutrient food compounds for a sufficient evaluation.

This PhD study provides new knowledge to the scientific base for future research on effects of organic food conversion in public kitchens to compare with and additional research is needed to extend the evidence base in this area.

7. References

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8. Appendices

8.1 Overview

Appendix 1: Paper I

Appendix 2: Paper II

Appendix 3: Paper III

Appendix 4: Questionnaire, wellbeing at work (Paper III)

Paper I

The Danish Organic Action Plan 2020: assessment method and baseline status of organic procurement in public kitchens

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The Danish Organic Action Plan 2020: assessment method and baseline status of organic procurement in public kitchens

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Abstract

Objective: With political support from the Danish Organic Action Plan 2020, organic public procurement in Denmark is expected to increase. In order to evaluate changes in organic food procurement in Danish public kitchens, reliable methods are needed. The present study aimed to compare organic food procurement measurements by two methods and to collect and discuss baseline organic food procurement measurements from public kitchens participating in the Danish Organic Action Plan 2020.

Design: Comparison study measuring organic food procurement by applying two different methods, one based on the use of procurement invoices (the Organic Cuisine Label method) and the other on self-reported procurement (the Dogme method). Baseline organic food procurement status was based on organic food procurement measurements and background information from public kitchens.

Setting: Public kitchens participating in the six organic food conversion projects funded by the Danish Organic Action Plan 2020 during 2012 and 2013.

Subjects: Twenty-six public kitchens (comparison study) and 345 public kitchens (baseline organic food procurement status).

Results: A high significant correlation coefficient was found between the two organic food procurement measurement methods ($r=0.83$, $P<0.001$) with measurements relevant for the baseline status. Mean baseline organic food procurement was found to be 24% when including measurements from both methods.

Conclusions: The results indicate that organic food procurement measurements by both methods were valid for the baseline status report of the Danish Organic Action Plan 2020. Baseline results in Danish public kitchens suggest there is room for more organic as well as sustainable public procurement in Denmark.

Keywords
Organic food
Public procurement
Measurement methods
Organic food conversion

In 2011, the Danish Ministry of Food, Agriculture and Fisheries launched the Danish Organic Action Plan 2020, intending to double the organic agricultural area in Denmark by 2020⁽¹⁾. The main strategy to achieve this is to increase the overall demand for organic agricultural products in Denmark and hence stimulate farmers' motivation to convert from conventional to organic food production⁽¹⁾. With approximately half a million public meals produced per day, the Danish government considers public procurement to be a primary driver behind increasing the demand and hence increasing the organic production area⁽¹⁾. The plan aims to increase the organic food procurement up to 60% in all public kitchens in Denmark before 2020⁽¹⁾. This is in accordance with policy initiatives on the European level^(2,3). Consequently, the largest amount of funding in relation to the Danish

Organic Action Plan 2020 is earmarked for organic food conversion projects run by conversion managers in public kitchens⁽¹⁾.

Organic food production methods have shown to be more sustainable compared with conventional methods in relation to energy utilization, soil quality maintenance, water conservation, pest control and biodiversity improvements, along with limiting antibacterial regimen application, drug-resistant bacteria, fertilizer use, pesticide contamination and greenhouse gas emissions^(4–8). It is also possible to produce yields and to have economic returns per hectare of organic produce equal to that of conventional^(6–8); moreover, organic agricultural methods have been suggested as a solution to food insecurity and climate change mitigation⁽⁸⁾. However, sustainability also depends on local and seasonal food production along with food processing, packaging,

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distribution and consumption^(9,10). Importing organic food to meet national demands is likely to undermine sustainability effects achieved as a result of applying organic production methods, especially if the food is out-of-season and highly processed and packaged⁽¹¹⁾.

Organic food conversion can be viewed as an extensive transformation with several steps relevant to sustainability. Kitchens start by incorporating organic foods with the smallest price premiums like potatoes, cereals and milk and developing further to include more expensive products like meat. The conversion process becomes increasingly challenging as the public kitchens attempt to progress to higher organic food percentage levels within their existing budgets^(12,13) and part of the process therefore includes buying local and seasonal foods, less processed products, limiting meat consumption and reducing food waste^(14,15).

In terms of public health nutrition, the impact of organic food conversion in public kitchens remains unclear. The micronutrient content of individual organic foods compared with similar conventional foods, as well as whether or not organic foods contribute with significant additional nutritional and health benefits are issues still being researched and discussed^(7,16–20). However, studies on organic food conversion agree on positive associations between implementing organic food procurement and more nutritious diet compositions^(21–23). During organic food conversion, kitchens seem to develop menu plans more in line with national food-based dietary guidelines for the general population, i.e. by being based on more fruits and vegetables^(21,22,24). Organic food conversion in public kitchens may therefore affect the health of consumers by introducing more nutritious as well as more sustainable dietary compositions rather than due to possible quality differences within individual food products.

Neither organic action plans nor organic food conversions in public kitchens are new phenomena in Denmark or Europe^(25–29). Governmental initiatives on organic food conversion, such as the 'Green Shopping' scheme in Denmark⁽³⁰⁾ and several other cases in Finland, Italy and Norway researched by the Study of Innovative Public Organic Food Procurement for Youth (iPOPY) 2007–2010, have focused on organic food procurement^(31,32). The present Danish Organic Action Plan 2020 distinguishes itself by targeting various age groups through different types of public kitchens and aiming for a higher level of organic food procurement at the national level⁽¹⁾.

The Danish Organic Action Plan 2020 introduces another innovative feature by requesting baseline and endpoint organic food procurement measurements conducted in all participating public kitchens by applying the method specified as documentation for achieving the Organic Cuisine Label. The Organic Cuisine Label was launched in 2009 by the Danish Veterinary and Food Administration and represents the official Danish method to estimate organic food procurement⁽³³⁾. Kitchens can

apply for the label to promote their commitment to organic procurement if they can document one of the following three levels of organic procurement in the previous three months: 30–60 % (bronze), 60–90 % (silver) and 90–100 % (gold).

Unfortunately, public kitchens face severe challenges during organic food conversion such as inadequate food selection, unstable deliveries, a need for multiple suppliers and price premiums⁽¹³⁾. Attempts by the public kitchens to tackle the price premium of organic foods may be thwarted by limiting procurement contracts, resulting in kitchens not receiving the types and amounts of food needed to increase the organic food percentage⁽¹⁵⁾. Definitions and documentation requirements associated with the Organic Cuisine Label⁽³⁴⁾ are also still not clear to all public kitchens and these uncertainties have been identified as obstacles preventing kitchens in applying this method⁽¹⁵⁾.

Instead, a number of public kitchens have applied another method to measure organic food procurement called the Dogme method. The Dogme method was developed in 2005 as an online measurement tool to assess the organic food procurement based on self-reported estimations and background data on each kitchen⁽³⁵⁾. The tool is designed for internal use by kitchen employees rather than official registrations. Applying both of these two different methods to measure organic food procurement in relation to the Danish Organic Action Plan 2020 poses implications in relation to evaluating and monitoring the conversion process. The uncertainties related to the self-reported data that result from applying the Dogme method may also compromise future research on organic food conversions. Studies on nutritional quality of the menus and kitchen user satisfaction will depend on valid baseline measurements of the organic food procurement in order to assess any associations with organic food conversion. Research is needed to ensure valid measurements in relation to the Danish Organic Action Plan 2020.

The objectives of the present study were to compare organic food measurement estimations by the two methods and to collect and discuss baseline organic food procurement measurements from public kitchens participating in the Danish Organic Action Plan 2020. Based on these findings, implications of future organic food conversion are discussed in terms of sustainability and human health.

Methods

Comparison of the two measurement methods

A total of twenty-six public kitchens were recruited in order to compare measurements of organic food procurement by the Organic Cuisine Label method and the Dogme method. Kitchen contacts were obtained from the list of participants connected to the Danish Organic Action Plan 2020, from the Organic Cuisine Label registration

website⁽³⁶⁾ and from personal contact with organic conversion managers. Kitchens were invited to participate in the study by telephone or email, based on the following inclusion criteria: (i) the kitchen type was either a childcare institution or an elderly home; (ii) kitchens were able to apply both the Organic Cuisine Label method and the Dogme method for organic food procurement estimations; and (iii) the kitchens should represent levels of organic food procurement between 0 and 100 % to compare measurements across the full spectrum.

Childcare institutions and elderly homes were selected because these two types represent the majority of kitchens participating in the Danish Organic Action Plan 2020. The two kitchen types may have similar food production systems compared with hospitals and central kitchens procuring meals for several kitchen units, who apply more large-scale procurement methods and face different barriers to organic food conversion⁽¹²⁾. Nevertheless, childcare institutions and elderly homes vary considerably in terms of the consumer segments of the general population they target, along with what nutritional needs and dietary recommendations they need to consider during menu planning^(37,38). The procurement volumes found in childcare and elderly homes also vary. Elderly homes generally provide most or all meals for the consumers while childcare institutions usually provide one main meal and one to two in-between meals. These differences are likely to pose various challenges in the organic food conversion process in the two kitchen types, making them interesting to include.

To estimate the organic food procurement according to the Organic Cuisine Label method, invoices from the kitchen supplier during a three-month period were collected. The total procurement during these three months was divided into three categories: (i) organic foods, (ii) non-organic foods and (iii) neutral goods, as described by the calculation sheet developed by the Danish Veterinary and Food Administration⁽³⁶⁾. Neutral goods include non-food products, water, salt and game such as mammals or birds which are not considered in the organic procurement estimation. The calculation sheet can be downloaded freely online as a tool for all types of kitchens, automatically calculating the total organic food procurement when all goods have been entered into the sheet in either monetary value (Danish Krone) or weight (kilograms).

Organic food procurement levels estimated according to the Dogme method were performed online, using the Dogme web-based model⁽³⁵⁾. Background information on kitchen type, budget, procurement tonnage and geographic location, along with self-reported organic procurement of different food groups, was entered into the model and the estimated total organic food procurement level was recorded.

Baseline evaluation of the Danish Organic Action Plan 2020

In total, six organic food conversion projects received funding from the Danish Organic Action Plan 2020 during

2012 and 2013. The managers of the six organic food conversion projects independently recruited the participating public kitchens based on their individual area of expertise, network and kitchen volunteers. Consequently, the projects included different numbers and types of public kitchens, beyond childcare institutions and elderly homes. Public kitchens from all six projects were included for the baseline measurement evaluation. The organic conversion managers from each project were responsible for reporting baseline organic food procurement estimates for all participating kitchens by applying the Organic Cuisine Label method. The Dogme method was accepted in cases where the Organic Cuisine Label method was not applicable. Kitchen background information including number of employees, consumers, meals produced and kitchen type was collected using a web-based questionnaire and coupled to the reported organic food procurement estimates.

Data analysis

To evaluate the two measuring methods, the Spearman correlation was applied to account for non-normally distributed data⁽³⁹⁾. This was complemented by a Bland–Altman plot to evaluate the level of agreement between the measurements by the two methods, with limits of agreement defined as two times the standard deviation of the differences above and below the mean⁽⁴⁰⁾.

For the baseline evaluation, kitchens were grouped according to the following eight different kitchen types: (i) childcare; (ii) school food; (iii) after-school care; (iv) café or canteen; (v) elderly care; (vi) hospital kitchen; (vii) central kitchen; and (viii) residential institution. Descriptive statistics in terms of mean and standard deviation were used to describe the kitchen groups in relation to variables derived from the kitchen background information. These variables included the total number of employees working in the kitchen, number of consumers served by the kitchen and number of main meals as well as in-between meals produced by the kitchen per week.

Statistical analyses were carried out using the R statistical software package version i386 3.0.2 (R Inc., Boston, MA, USA).

Results

Comparison of the two measurement methods

Figure 1 shows the level of agreement between the two methods for estimating organic food procurement level performed in twenty-six kitchens (childcare institutions or elderly homes), ranging from 0 to 100 % organic food. The Spearman correlation coefficient between organic food procurement estimations by the Organic Cuisine Label method and the Dogme method showed a high correlation ($r=0.83$, $P<0.001$). The Bland–Altman plot (Fig. 2) confirms the high level of agreement between the two

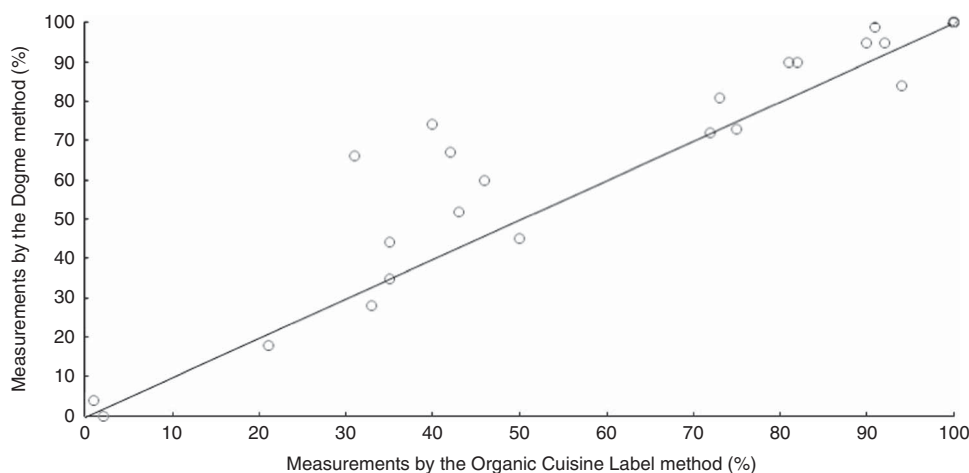


Fig. 1 Comparison of organic food procurement measurements by the Organic Cuisine Label method and the Dogme method among twenty-six public kitchens participating in the Danish Organic Action Plan 2020. The Spearman correlation coefficient between the two measurement methods was found to be significant ($r=0.83$, $P<0.001$)

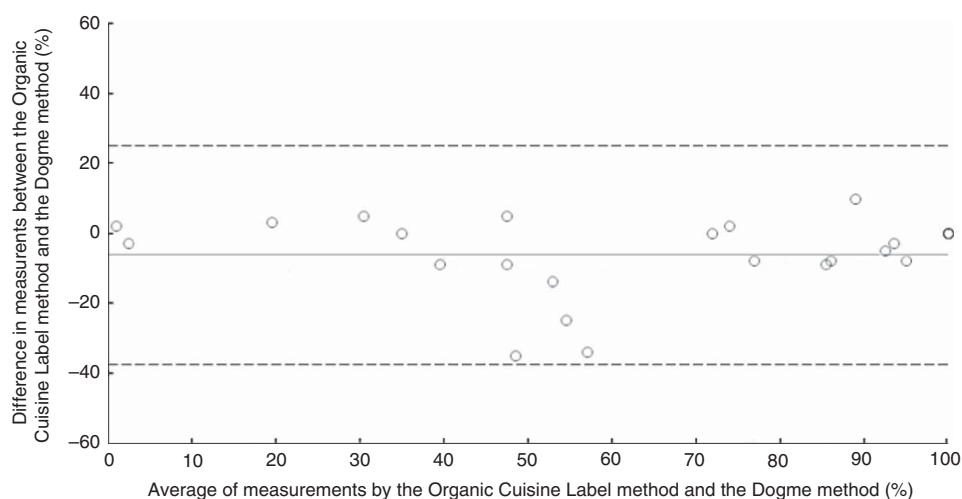


Fig. 2 Bland–Altman plot of agreement between measurements by the Organic Cuisine Label method and the Dogme method among twenty-six public kitchens participating in the Danish Organic Action Plan 2020. The average organic food procurement level by the two methods is represented on the x-axis and the difference between the two methods is represented on the y-axis. The middle line (—) indicates the mean difference ($y=-6$), with the top and bottom lines (---) showing the upper and lower limits of agreement ($y=25$ and -37), respectively

methods, with a bias of -6% and limits of agreement between -37% and 25% . However, both figures indicate an increased level of disagreement between the two measurement methods at certain organic food procurement levels. In Fig. 1, outlying estimations were identified at measurement levels between 55 and 75 % according to the Dogme method (y -axis) and between 30 and 45 % according to the Organic Cuisine Label method (x -axis). These outliers remain in Fig. 2 where disagreement is identified at the average estimation level between approximately 48 and 58 %. As the mean difference (bias) was found to be negative, the results of the comparison study show a generally higher trend of overestimation in measurements by the Dogme method compared with the

Organic Cuisine Label method. Therefore, these results suggest that organic food procurement estimations by the Dogme method of 55–75 % carry an increased level of uncertainty and may overestimate the true procurement level.

Baseline evaluation of the Danish Organic Action Plan 2020

Characteristics of the kitchens participating in the Danish Organic Action Plan 2020 are shown in Table 1. Baseline organic food procurement data were collected from 345 of the 349 public kitchens taking part in the Danish Organic Action Plan 2020. Four kitchens were excluded from the study based on lacking estimations of organic food

Table 1 Characteristics of kitchens participating in the Danish Organic Action Plan 2020 (*n* 345)

Kitchen type*	<i>n</i>	Employee [†]		Consumers per day [‡]		Main meals per week [§]		In-between meals per week		Organic Cuisine Label measurements [¶]	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	<i>n</i>	%
Childcare	210	1	2	54	45	59	158	62	182	164	78
School food	16	3	3	75	61	193	241	83	187	10	63
After-school care	20	0	0	109	68	2	2	29	108	8	40
Café or canteen	42	4	4	296	335	414	567	26	55	37	88
Elderly care	28	5	5	138	108	421	836	86	165	11	39
Hospital kitchen	7	44	29	949	833	8953	6202	3234	3388	7	100
Central kitchen	4	37	35	1483	1317	10479	18118	2979	5150	4	100
Residential institution	18	2	1	36	21	103	190	41	78	14	78

*Childcare includes all childcare institutions such as nurseries, kindergartens and integrated institutions; school food includes school canteens and home-cooking classes; after-school care covers institutional after-school care; café or canteen includes canteens or cafés associated with workplaces, universities, activity centres or cultural venues; elderly care includes homes for the elderly; hospital kitchen covers patient procurement; central kitchen includes large-scale food production kitchens delivering procurement for receiving kitchens; residential institution includes institutions in which consumers live permanently (i.e. social care facilities, university boarding schools and barracks).

[†]Total number of full-time positions in the kitchen (37 h/week).

[‡]Total number of people served by the kitchen.

[§]Total number of breakfasts, lunches and dinners served by the kitchen per week, self-reported. Institution types open for production 5 d/week: childcare, school food, after-school care and café or canteen. Institution types open 7 d/week: elderly care, hospital kitchen, central kitchen and residential institution.

^{||}Total number of mid-morning and mid-afternoon in-between meals served by the kitchen per week, self-reported. Institution types open 5 d/week: childcare, school food, after-school care and café or canteen. Institution types open 7 d/week: elderly care, hospital kitchen, central kitchen and residential institution.

[¶]Baseline organic food procurement measurements by the Organic Cuisine Label method.

Table 2 Organic food procurement at baseline in Danish public kitchens participating in the Danish Organic Action Plan 2020

Kitchen type*	<i>n</i>	Organic food procurement (%) [†]		Kitchens at Organic Cuisine Label levels (%) [‡]			
		Mean	SD	No label (0–30 %)	Bronze (30–60 %)	Silver (60–90 %)	Gold (90–100 %)
Childcare	210	56	0.30	22	28	33	17
School food	16	29	0.31	63	19	6	12
After-school care	20	23	0.28	65	20	10	5
Café or canteen	42	13	0.18	83	10	7	0
Elderly care	28	33	0.33	54	18	25	4
Hospital kitchen	7	16	0.19	71	29	0	0
Central kitchen	4	9	0.08	100	0	0	0
Residential institution	18	14	0.16	89	11	0	0
All	345	24					

*Childcare includes all childcare institutions such as nurseries, kindergartens and integrated institutions; school food includes school canteens and home-cooking classes; after-school care covers institutional after-school care; café or canteen includes canteens or cafés associated with workplaces, universities, activity centres or cultural venues; elderly care includes homes for the elderly; hospital kitchen covers patient procurement; central kitchen includes large-scale food production kitchens delivering procurement for receiving kitchens; residential institution includes institutions in which consumers live permanently (i.e. social care facilities, university boarding schools and barracks).

[†]Baseline organic food procurement estimations by kitchen type. Includes estimations derived by applying the Organic Cuisine Label method or the Dogme method.

[‡]Percentage of kitchens divided into the different Organic Cuisine Label levels at baseline by kitchen type. Include estimations calculated by the Organic Cuisine Label method and the Dogme method.

procurement by either measurement method. The total mean organic food procurement of all eight types of public kitchens was found to be 24 % when including measurements from both methods (see Table 2).

Of the 345 included public kitchens, 255 applied the Organic Cuisine Label method to estimate organic food procurement, which corresponds to 74 % (see Table 1). The remaining ninety public kitchens used the Dogme method and of these organic food procurement measurements, 4 % were in the 55–75 % interval. The results in Table 1 show that hospital and central kitchens were few in number but significantly larger in terms of staffing and procurement. All public kitchens within these two types were also able to apply the Organic Cuisine Label method

to measure the organic food procurement. The proportion of kitchens applying this method within elderly care and after-school care was much lower.

The different levels of mean organic food procurement according to the Organic Cuisine Label qualifications by kitchen type are shown in Table 2. The mean organic food procurement levels for childcare, school food and elderly care kitchens are the highest of the eight types of public kitchens. Almost all three kitchen types qualify for the Organic Cuisine Label in bronze (30–60 %) at baseline and half of all childcare institutions (*n* 106) have an organic procurement level between 60 and 100 % (silver or gold label level). In comparison, hospital kitchens and central kitchens are among the kitchen types with the lowest

mean organic food procurement level and furthermore, none of these types include individual kitchens qualifying for more than the bronze label at baseline.

Discussion

The present study found that organic food procurement measurements by the Organic Cuisine Label method and the Dogme method are comparable at relevant percentage levels. Tendencies of overestimation were identified at organic food procurement measurements of 55–75 % and when measured by the Dogme method. When considering measurements from both methods, the mean organic food procurement baseline status among the 345 public kitchens participating in the Danish Organic Action Plan 2020 during 2012 and 2013 was found to be 24 %.

At implementation stage, most organic food procurement measurements will remain at low percentage levels. When considering the results of the comparison study, measurements of organic food procurement by the two different methods compared well at lower percentage levels and it is therefore reasonable to consider measurements by both methods for the baseline status of the Danish Organic Action Plan 2020. However, an increased level of disagreement was identified at higher procurement levels with overestimated measurements by the Dogme method between 55 and 75 %. This finding is important in terms of conducting organic food procurement measurements at a later stage during a conversion where more public kitchens are expected to measure higher levels of organic food procurement. Overestimations by the Dogme method may not be surprising as the design is based on self-reported organic procurement. However, applying the Dogme method will introduce unnecessary uncertainties which can be avoided by applying the Organic Cuisine Label method. In terms of endpoint evaluation of organic food conversions, where more public kitchens are likely to have reached organic food procurement levels of 55–75 %, the Organic Cuisine Label method will ensure more reliable results. Results of the comparison study also suggest that measurements by the two methods are comparable at organic food procurement levels of 100 % but not all public kitchens will be able to reach this level within the duration of the organic food conversion projects. Consequently, applying the Organic Cuisine Label method for the endpoint evaluation is recommended.

The Organic Cuisine Label method has proven to result in uniform, standardized and documented calculations of the organic food procurement by incorporating invoices from suppliers. Thereby, the original intention of applying this method exclusively is supported with the following rationale: (i) enabling the kitchens to track their progress during the organic conversion by applying an officially acknowledged method; (ii) guiding the kitchens in

applying for and maintaining the Organic Cuisine Label once they are qualified, which is expected to enhance the chances of successful long-term implementation; and (iii) conducting more reliable measurements for the evaluation of the Danish Organic Action Plan 2020. Reliable endpoint measurements are necessary to evaluate whether targets were met, to support further research and to gain insight into best practices for future conversion projects.

The results of the Danish Organic Action Plan 2020 baseline status reveal patterns among the participating public kitchens in relation to their procurement structures, measurement method and organic food procurement level. Hospital kitchens and central kitchens were able to apply the Organic Cuisine Label method exclusively despite having a low mean organic food procurement level. The large-scale procurement structure within these kitchen types may support the application of the Organic Cuisine Label method, even when the kitchens have little or no prior experience with organic food conversion. Childcare, school food and elderly care kitchens seemed to have more difficulties applying the Organic Cuisine Label method but documented higher mean organic food procurement levels. The high level of organic food procurement at baseline in childcare, school food and elderly care kitchens may illustrate uncertainties introduced by applying the Dogme method as described above, but it might also be a result of the increased experience with organic food conversion. In Denmark, these kitchen types have been introduced to organic food conversion before^(41–43), and baseline status among them may therefore be higher.

Whether organic food conversion projects aiming to implement organic food conversion should include kitchens with a certain level of experience in organic food procurement is debatable. Either way, it seems even public kitchens with an organic food procurement above 50 % are motivated to participate in the Danish Organic Action Plan 2020 and possibly advance to 100 %. However, the high level of organic procurement estimated in childcare, school food and elderly care kitchens at baseline poses challenges in terms of further conversion as organic procurement becomes more demanding at increasing shares. The low mean baseline status for the remaining five types of public kitchens (in total n 91) seems to represent an audience which has not been included to the same extent in organic food conversion initiatives before, carrying greater potential in terms of increasing the level of organic food procurement. Organic food conversion in these types of public kitchens will be important to explore in the future to meet the targets of the Danish Organic Action Plan 2020.

As described in the 'Methods' section, neither the Organic Cuisine Label method nor the Dogme method explicitly accounts for local or seasonal foods in the measurements. This is an important issue to consider when evaluating the Danish Organic Action Plan 2020 in terms of sustainability.

Past experiences with organic food conversions have resulted in a greater focus on health, environment and sustainability with public kitchens buying local and seasonal foods along with limiting food waste, partly in order to make budget cuts to afford the premium price of organic food⁽¹³⁾. However, with public kitchens being evaluated only based on the organic food procurement level, little incentive is left for the kitchens to demand local organic produce in periods where imported organic produce might be available at a lower price. Public kitchens have earlier expressed a strong motivation to collaborate with local suppliers even if the planned and ordered products are not always available in organic versions⁽¹⁵⁾. This motivation should be encouraged to increase sustainability.

In terms of health, one main expected effect of increased organic public food procurement is the decreased intake of chemical fertilizer and pesticide residues among consumers. Effects on nutrient intake are more uncertain as significant differences in micronutrient content between individual organic and conventional food products have not yet been established. Nutritional improvements of future organic food conversions in public kitchens are more likely to result from healthier meal compositions. Apart from organic food conversions in public kitchens, the Danish Organic Action Plan 2020 also included measures targeting the Danish agricultural sector to assist in conversion of farmland from conventional to organic⁽¹⁾, which may carry health benefits in terms of water quality. Overall, the Danish Organic Action Plan 2020 carries great potential to improve sustainability, but care should be taken to ensure a holistic development within health, environment and food quality rather than promoting organic food procurement alone.

To the best of the authors' knowledge, this is the most extensive organic food conversion baseline registration reported to date. It would have been interesting to compare measurements of organic public food procurement at the national level with results from other countries, but no similar studies were available. Related studies in organic public procurement explore settings and initiatives across European countries, but do not include measurements of organic food procurement across different types of public kitchens^(44,45). This area therefore calls for further research.

A limitation of the present study to consider when interpreting the results includes the small sample size for the comparison of the Organic Cuisine Label method and the Dogme method. Nevertheless, the exploratory value of the study remains significant, with varying levels of organic food procurement included to improve the understanding of the measurement methods.

Conclusion

Results of the present study show that organic food procurement estimations by both the Organic Cuisine Label

method and the Dogme method are comparable within the percentage levels relevant at baseline. Furthermore, the mean public organic food procurement in Denmark registered at 24 % leaves room for an increase in organic procurement and possibility to improve the sustainability and nutritional quality of Danish public meals. This baseline status report of organic food procurement in Danish public kitchens hereby provides the first step towards a successful implementation and evaluation of the Danish Organic Action Plan 2020 in terms of public health nutrition and sustainability.

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Paper II

Effectiveness of the Danish Organic Action Plan 2020 in increasing the level of organic public procurement in Danish public kitchens

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1 **Effectiveness of the Danish Organic Action Plan 2020 in increasing the level of organic public**
2 **procurement in Danish public kitchens**

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14

15 **Funding:** This work was supported by the legislative Finance Act for 2013: “Green conversion and
16 growth” under the topic of “Assessment of effects of the organic conversion projects 2013-2016” by
17 the Danish Ministry of Food, Agriculture and Fisheries.

18 **Running head:** Effectiveness of the Danish Organic Action Plan 2020

19 **Keywords:** Organic food conversion, public procurement, nutrition, sustainability, education

20

21 **Objective:** To measure the effect of organic food conversion projects on the organic food
22 percentages in Danish public kitchens participating in the Danish Organic Action Plan 2020.

23 **Design:** This longitudinal study was based on measurements of organic food percentages in Danish
24 public kitchens before and after participation of kitchen employees in conversion projects.

25 **Setting:** Public kitchens participating in the nine organic food conversion projects under the Danish
26 Organic Action Plan 2020, initiated during fall 2012 and spring 2013 and completed in summer
27 2015.

28 **Subjects:** A total of 622 public kitchens.

29 **Results:** The average (median) increase in organic food percentage from baseline to follow-up was
30 24 percentage points ($p < 0.001$) during an overall median follow-up period of 1.5 years. When
31 analysing data according to public kitchen types, the increase remained significant for seven out of
32 eight public kitchen types. Furthermore, the proportion of public kitchens eligible for either the
33 Organic Cuisine Label in silver (60-90% organic food procurement) or gold (90-100% organic food
34 procurement) labels doubled from 31% to 62%, respectively during the conversion period.
35 Conversion project curriculum mostly included elements of “theory”, “menu-planning”, “network”
36 and “Organic Cuisine Label method” to ensure successful implementation.

37 **Conclusion:** This study reports significant increases in the level of organic food procurement
38 among public kitchens participating in the Danish Organic Action Plan 2020. Recommendations for
39 future organic conversion projects include adding core curriculum components to the project
40 educational content and measuring changes in organic food percentage to increase the chances of
41 successful implementation.

Organic food conversion programs targeting public kitchens have been developed and implemented in Denmark as well as internationally for more than two decades⁽¹⁻⁴⁾. Organic food conversion programs have been suggested to affect not only the environmental sustainability of public procurement but also the diet compositions of the meals served in the public kitchens by increasing the amount of legumes, fruit and vegetables and reducing the amount of meat and meat products applied⁽⁵⁻⁷⁾. Also reduced food waste and increased consumption of seasonal and local food products have been highlighted in relation to the potential benefits of organic food conversion programs on improving sustainability within public procurement⁽⁸⁻¹⁰⁾.

These aspects formed part of the justification by the Danish Ministry of Food, Agriculture and Fisheries when launching the Danish Organic Action Plan 2020 in 2011⁽¹¹⁾, revised in 2015⁽¹²⁾. In accordance to the Action Plan for the future Organic Production in the European Union⁽¹³⁾, the Danish initiative aims to improve sustainability, biodiversity and animal welfare by stimulating the demand for Danish organic agriculture through a primary focus on increased public procurement of organic foods. Organic food conversion projects managed by different institutions have therefore been able to apply for funding since fall 2012 to implement educational training targeted public kitchen employees. It is important to point out that no funding was available to cover the price premiums associated with organic food purchase.

However, the effectiveness of such organic food conversion projects in increasing the level of organic procurement in public kitchens has to our knowledge not previously been documented. With the well-known and severe challenges faced by public kitchens during organic food conversion including unstable deliveries, challenging procurement policies and an increased premium price^(10,14,15), an evaluation of the level of success of the conversion projects in terms of specific measurements of organic food percentage in the public kitchens is needed⁽³⁾. Launched in 2009 by the Danish Veterinary and Food Administration, the Organic Cuisine Label represents such specific and valid measurements⁽¹⁶⁾. The Organic Cuisine Label includes four organic food percentage intervals to establish the level of each kitchen: 0-30% (no label), 30-60% (bronze label), 60-90% (silver label) and 90-100% (gold label), based on procurement invoices. Evaluation measurements of this type has been called for during past conversion programs⁽³⁾. Furthermore, knowledge on the specific educational content of the conversion projects will be valuable elements in a discussion guiding future initiatives on potential best-practise training of public kitchen employees.

73 The primary objective of this study is therefore to measure changes in organic food percentages in
 74 Danish public kitchens participating in organic food conversion projects under the Danish Organic
 75 Action Plan 2020 from fall 2012 to spring 2013. Furthermore, the curriculum of the different
 76 organic food conversion projects will be evaluated.

77

78 **Methods**

79 *Survey design and recruitment*

80 The present study was a longitudinal study measuring the organic food percentage in Danish public
 81 kitchens before and after an organic food conversion program.

82 Recruitment took place during 2012-2013 and encompassed a total of 10 different conversion
 83 projects including 666 public kitchens receiving funding from the Danish Organic Action Plan
 84 2020. One project including 18 public kitchens was excluded from the study due to an extended
 85 conversion period compared to the remaining nine projects. Of the 647 remaining public kitchens, a
 86 total of 36 public kitchens were combined to 13 during the conversion period due to external factors
 87 and two public kitchens were lost to follow-up. The 622 public kitchens completing the nine
 88 conversion projects, included public kitchen types classified as childcare, school, afterschool,
 89 canteen, elderly, hospital, central or residential institution based on categories developed by the
 90 Danish Diet and Nutrition Association⁽¹⁷⁾. Median (IQR) conversion period was 1.5 years (1.0-
 91 1.75).

92 The study was performed in accordance with the ethical standards of the Helsinki Declaration of
 93 1975, as revised in 2008⁽¹⁸⁾.

94 *Data collection*

95 In collaboration with the conversion project managers and the public kitchens, organic food
 96 percentages were collected through completion of the Organic Cuisine Label method sheet and a
 97 background questionnaire survey for each kitchen. The Organic Cuisine Label method by the
 98 Danish Veterinary and Food Administration⁽¹⁶⁾ is based on procurement invoices over a period of
 99 three months from suppliers to automatically calculate the organic food percentage in either
 100 monetary value or weight⁽¹⁹⁾. More detailed description of the calculation method can be found

elsewhere⁽¹⁰⁾. In a few cases, kitchens were unable to apply the Organic Cuisine Label method and instead applied the Dogme method⁽²⁰⁾. This method is an online measurement tool based on self-reported organic food product use and background information by kitchen employees. The method has been found to have a high correlation in measurements compared to the Organic Cuisine Label method except for the interval between 55-75% where increased uncertainties have been identified⁽¹⁰⁾. The method was therefore accepted for baseline measurements where the Organic Cuisine Label method was inapplicable. The background information survey included number of employees, consumers, meals produced and kitchen type for each kitchen.

To investigate potential differences in educational approach towards organic food conversion between the nine different conversion projects, project curriculum content was mapped. Information for the mapping originated from official descriptions of the individual conversion projects forming part of their funding applications.

Outcomes

The 622 participating public kitchens were grouped according to kitchen types. The extent of organic food conversion was defined as the proportion of organic food produced by the individual public kitchens. The change in organic food percentage was recorded both in terms of intervals relevant for the Organic Cuisine Labels as well as individual measurements.

Based on prior experiences with organic food conversion^(8,21,22) as well as dialogues with relevant conversion managers, the following 12 educational components were identified as either present or absent within each project:

- “Mapping of kitchen production system before start”
- “Theory of organic food (production, health, environment)”
- “Past experiences and success-stories on conversion”
- “Practical cooking classes (local and seasonal)”
- “Nutritional guidelines relevant for kitchen users”
- “Menu-planning with new production systems”
- “Budgeting for more organic food within previous budget”
- “Food-waste lessons on re-use of leftovers”
- “Fieldtrips for kitchen employees to farms and producers”

- 130 • “Network between/among kitchens, suppliers and producers”
- 131 • “Organic Cuisine Label method introduction and application”
- 132 • “Follow-up visit offers to individual kitchen participants”.

133 *Analysis*

134 The analyses were based on ordinal measurements of organic food percentage from baseline to
 135 follow-up. As data could not be considered normally distributed, non-parametric statistical
 136 hypothesis testing of differences between baseline and follow-up were made using Wilcoxon signed
 137 rank test (paired). This was done for all public kitchens included and according to kitchen types
 138 along with the median, 1st and 3rd quartiles. Wilcoxon signed rank statistical analyses (paired) were
 139 done using RStudio statistical software package version 0.98.1103 (R Inc., Boston, Massachusetts,
 140 USA).

141

142 **Results**

143 Of the 622 public kitchens, more than half were of the type childcare (56%) followed by canteen
 144 (15%) and elderly (10%) (Table 1). School and residential were both represented by 7%, afterschool
 145 represented by 3% and both hospitals and central kitchens were represented by 1% each. However,
 146 in terms of main meals produced per week, central kitchens reported the highest proportion at 35%
 147 followed by childcare (24%), canteen (14%), elderly (10%), hospital (9%), residential (4%), school
 148 (3.5%) and lastly, afterschool (0.5%) (not shown).

149 *Change in organic food percentages*

150 As presented in Table 2, a significant increase in organic food percentage was identified for the
 151 total of 622 public kitchens from a median (IQR) of 38% (6-66) at baseline to 69% (48-83) at
 152 follow-up ($p<0.001$), with a difference in medians of 24 percentage points. When calculating the
 153 overall the organic food percentage per kitchen type at baseline and follow-up using average rather
 154 than median, the result was 22% at baseline and 47% at follow-up. Significant increases in organic
 155 food percentage were furthermore identified for seven of the eight kitchen types ($p<0.05$), where no
 156 changed was observed for the afterschool kitchen type ($p=0.16$) (Table 2).

157 In terms of shifts in Organic Cuisine Label intervals, Figure 1 illustrates the number of public
 158 kitchens with organic food percentages within each interval at baseline and follow-up. The total
 159 number of kitchens in the 0-30% (no label) interval decreased from 270 at baseline to 63 kitchens at
 160 follow-up. The number of kitchens in the following three intervals increased from 162 to 174 (30-
 161 60%, bronze), from 136 to 282 (60-90%, silver) and from 54 to 103 (90-100%, gold) from baseline
 162 to follow-up, respectively.

163 *Organic food conversion project content components*

164 Mapping the project curriculum of the nine different organic food conversion projects showed both
 165 similar trends and deviances (Table 3). Of the nine projects, five were managed by producer
 166 associations, three by accounting companies and one managed by a university. All projects
 167 specifically described “Theory of organic food (production, health, environment)”, “Menu-planning
 168 with new production systems and routines”, “Network between/among kitchens, suppliers and
 169 producers” and “Organic Cuisine Label method introduction and application” as part of the
 170 curriculum. Except for one project, they all also included “Past experiences and success-stories on
 171 conversion”, “Practical cooking classes (local and seasonal)”, “Nutritional guidelines relevant for
 172 the kitchen users”, “Budgeting for more organic food within previous budget” and “Food-waste
 173 lessons on re-use of leftovers”. Oppositely, only two projects included “Follow-up visit offers to
 174 individual kitchen participants”, six projects included “Fieldtrips for kitchen employees to farms
 175 and producers” and seven included “Mapping of kitchen production system”.

176

177 **Discussion**

178 Results from this study showed an average (median) increase in the organic food percentage from
 179 baseline to follow-up of 24 percentage point during an overall median follow-up period of 1.5 years
 180 ($n=622$, $p<0.001$). When analysing the data according to public kitchen types, the increase in
 181 organic food percentage remained significant for seven of the eight different kitchen types. This
 182 significant increase was also illustrated by a significant shift in numbers of public kitchens within
 183 the four different Organic Cuisine Label intervals, approximately doubling the number of kitchens
 184 eligible for either silver (60-90%) or gold (90-100%) labels. The mapping of conversion project
 185 curriculum revealed four educational components prioritised by all nine projects: “Theory of
 186 organic food (production, health, environment)”, “Menu-planning with new production systems and

187 routines”, “Network between/among kitchens, suppliers and producers” and “Organic Cuisine Label
188 method introduction and application”.

189 Despite the relatively long history of organic food conversion in Danish public kitchens, this is the
190 first study to meet the call from previous research^(3,21) and present data on the organic food
191 percentage in public kitchens during organic food conversion through strictly regulated Organic
192 Cuisine Label method measurements⁽²³⁾. Related European initiatives on organic public
193 procurement have explored similar settings and intentions as the Danish Organic Action Plan
194 2020^(24,25) but no studies documenting specific organic food percentages comparable to the results
195 presented here have been found.

196 All nine conversion projects included components on theory, menu-planning, network and Organic
197 Cuisine Label method and almost all included past success stories, practical training, nutritional
198 guidelines, budgeting and food-waste. These may therefore be considered core to a successful
199 implementation of organic food production in public kitchens. Results from past experiences
200 highlight similar elements in their description of important steps towards organic food
201 conversion^(26,27). The theory component allows for kitchen employees to understand the differences
202 between organic and conventional food in terms of the food product they buy and prepare as well as
203 how they were produced, where practical classes enable the employees to familiarise themselves
204 with and prepare organic meals made from local and seasonal raw foodstuffs rather than
205 convenience products⁽²¹⁾. Menu-planning, budgeting and food-waste management are necessary to
206 optimise the food production in the kitchen and save resources that can cover the premium prices of
207 organic food⁽²⁸⁾. Including nutritional guidelines in the educational content ensures that the
208 reformulated organic meals cover the nutritional needs of the kitchen users, whether that would be
209 children, elderly or hospitalised patients⁽⁶⁾. Also components on networking, past success stories
210 and the Organic Cuisine Label method were important to the conversion projects. According to
211 recent evaluations, networking platforms are important to improve communication among kitchens
212 and suppliers, where past success stories and introducing the labels help motivating and anchoring
213 the implementation of organic food after the conversion project ends^(8,22).

214 The last components of mapping kitchens, fieldtrips and follow-up visits might have been more of
215 selective kind. Discussions with conversion managers suggested that mapping kitchens production
216 system before intervening was almost always done but perhaps more indirectly, while others argued
217 that it was a waste of time as usually kitchens would change their shopping and menu habits before

the start of the project anyway. Fieldtrips were often included in the conversion projects to motivate the kitchen employees, but conversion managers stated that they would leave them out if budget and time constraints were limited. Conversion managers also mentioned the theory component to be a motivational factor, which is of great importance among kitchen employees. These statements are in agreement with previous findings^(8,21,29).

This knowledge of the curriculum of conversion projects illustrates a high level of complexity within the implementation of organic food production in public kitchens. Conversion projects seem to design and tailor a lot of the educational content according to kitchen type, size, nutritional needs of the kitchen user group, economic budget limitations in the kitchen and sustainability of both the conversion in itself after the project ends as well as the environmental sustainability. The core components discussed above seem to be interrelated to a degree where the project simply would not be possible to implement without considering them all. In this view, organic food conversion appears to be tightly linked to sustainability and public health. Increased organic public procurement supports organic food production which in itself has been shown to be more sustainable in terms energy use, greenhouse gas emissions, soil health and yields compared to conventional food production^(9,30–37). Furthermore, the discussion above confirm the presence of important sustainability aspects in the conversion project content such as more environmental awareness of the kitchen employees, increased use of local and seasonal food products and limited food-waste, as argued earlier⁽⁶⁾.

In terms of public health, most conversion projects in this study included educational training on “Nutritional guidelines relevant for the kitchen users”. This shows that the nutritional needs of the kitchens users will not be compromised as a result of the conversion project. In fact, it might result in meal compositions more in line with the recommendations^(7,38,39). Also, an increasingly important aspect to consider in the public health discussion is the dietary exposure to pesticides, fertilisers, antibiotics and other chemicals⁽⁴⁰⁾, which can have severe adverse effects on human reproductive and child health^(41,42) and which can be avoided through organic food consumption^(43–45).

Limitations to this study include the lack of control public kitchens that were not exposed to the organic food conversion process, which renders the results unable to directly infer causality. With the small number of participating public kitchens not completing the conversion project, loss to follow-up bias may not be a great risk but the risk of introducing selection bias cannot be excluded as the public kitchens were not randomly selected for the conversion projects. Another limitation

249 may be the use of conversion project descriptions as these may not have been updated in terms of
250 actual project content implemented. This was however corrected for to a certain extent during
251 project manager discussions. Additional qualitative interviews with project managers and kitchen
252 employee participants could have been interesting to include as well as observations during
253 conversion project implementation.

254 In conclusion, this study reports significant increases in organic food percentage with a difference
255 in medians of 24 percentage points among 622 participating public kitchens during a median
256 conversion period of 1.5 years, along with a significant shift in the number of public kitchens
257 eligible for Organic Cuisine Labels at the silver and gold level. Hence, the results indicate
258 significant effects of organic food conversion projects on increasing the organic food percentage in
259 public kitchens within their existing budgets. The mapping of educational content components of
260 the conversion projects identified core components in terms of theory, past success stories, practical
261 training, nutritional guideline, menu-planning, budgeting, food-waste managing, networking and
262 Organic Cuisine Label components, which may be associated with improved nutrition and
263 sustainability. These results represent new research supporting future implementation of initiatives
264 similar to the Danish Organic Action Plan 2020.

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382

Table 1 Proportion of meals, kitchen users and employees in the eight different types of participating public kitchens across the nine included conversion projects

Kitchen type^a	Kitchens (%)	Employees (%)	Kitchen users (%)	Main meals (%)^b	Other (%)^c
N	622	3.505	69.299	735.317	387.942
Childcare	56	14	32	24	43
School	7	3	9	3.5	6
Afterschool	3	0	3	0.5	3
Canteen	15	12	24	14	16
Elderly	10	54	8	10	11
Hospital	1	9	9	9	9
Central	1	6	12	35	9
Residential	7	2	3	4	3

^a**Childcare** includes all childcare institutions such as nurseries, kindergartens and integrated institutions; **School** includes school canteens and school-cooking classes; **After-school** covers institutional after-school care; **Canteen** includes canteens or cafés associated with workplaces, universities, activity centres or cultural venues; **Elderly** includes homes for elderly; **Hospital** covers patient procurement; **Central** includes large-scale food production kitchens delivering procurement for receiving kitchens; **Residential** includes institutions in which consumers live permanently (i.e. social care facilities, university boarding schools and barracks).

^bTotal number of breakfasts, lunches and dinners produced per week, self-reported. Kitchen types open for production 5 d/week: childcare, school food, after-school and canteen. Institution types open 7 d/week: elderly, hospital, central and residential.

^cTotal number of snacks and in-between meals produced per week, self-reported. Kitchen types open 5 d/week: childcare, school, after-school and canteen. Institution types open 7 d/week: elderly, hospital, central and residential.

Table 2 Changes in organic food percentage across kitchen types from the nine different conversion projects during the organic food conversion period from baseline to follow-up

Quartiles	N	Baseline		Follow-up		Difference		P-value^b
		Median	(IQR)	Median	(IQR)	Median	(IQR)	
All ^a	622	38	(6-66)	69	(48-83)	24	(11-43)	<0.001
Kitchen types								
Childcare	349	59	(40-78)	81	(70-92)	21	(7-36)	<0.001
School	41	17	(8-35)	49	(26-58)	22	(12-39)	<0.001
Afterschool	18	6	(1-41)	40	(6-54)	8	(2-30)	0.163
Canteen	91	3	(0-15)	43	(31-64)	35	(24-45)	<0.001
Elderly	64	2	(0-23)	51	(41-65)	40	(21-50)	<0.001
Hospital	7	1	(1-29)	20	(9-45)	16	(1-19)	0.022
Central	8	4	(1-17)	40	(31-55)	34	(28-44)	0.016
Residential	44	14	(0-30)	53	(41-64)	35	(21-48)	<0.001

^aOverall calculations included participating kitchens from all projects regardless of kitchen types

^bWilcoxon signed rank test, paired (RStudio)

Figure 1 Number of public kitchens participating in the organic food conversion projects with organic food percentages at the relevant intervals required for the Organic Cuisine Labels measured at baseline and endpoint (n=622)

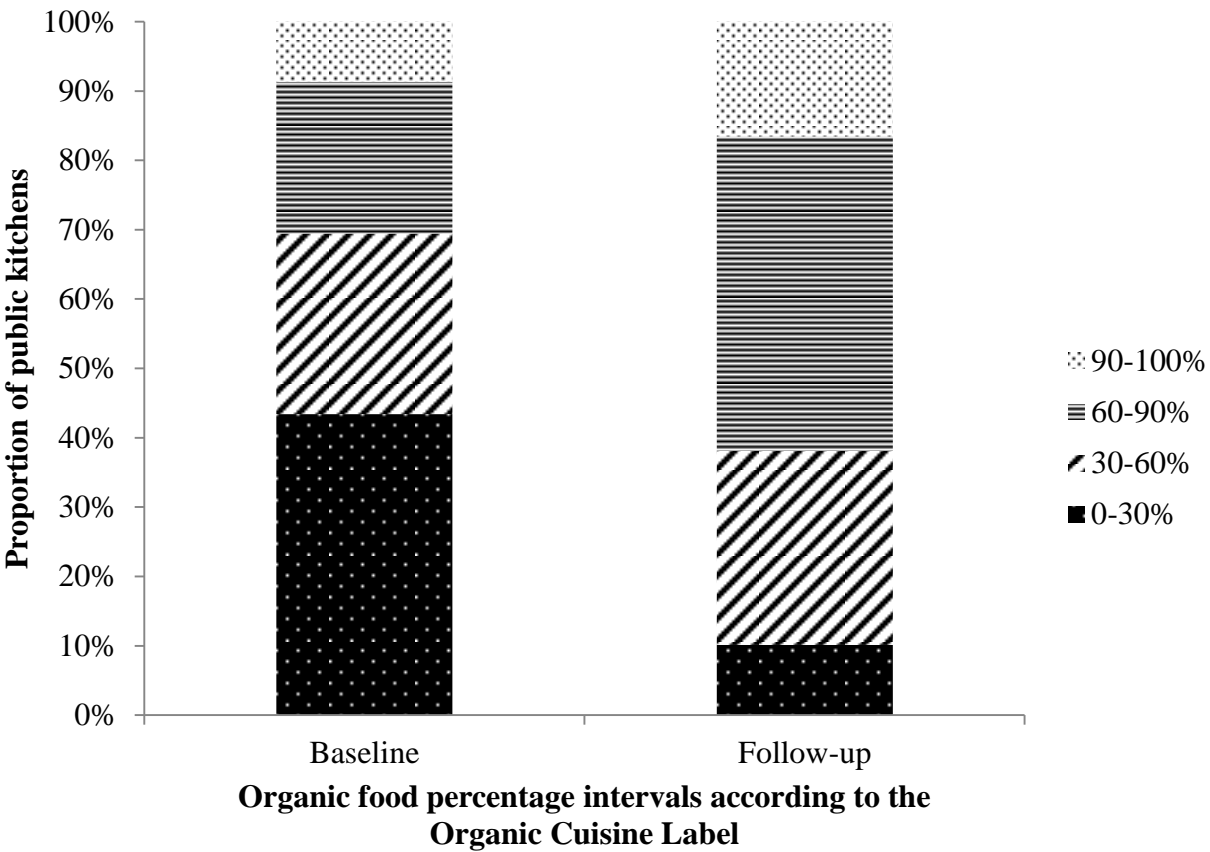


Table 3 Organic food conversion educational components included in the nine conversion projects implemented with funding from the Danish Organic Action Plan 2020 targeting public kitchens

	Conversion projects								
	1	2	3	4	5	6	7	8	9
Project educational content components									
Mapping kitchen food production system before start		X	X		X	X	X	X	X
Theory of organic food (production, health, environment)	X	X	X	X	X	X	X	X	X
Past experiences and success-stories on conversion	X	X	X		X	X	X	X	X
Practical cooking classes (local and seasonal)		X	X	X	X	X	X	X	X
Nutritional guidelines relevant for kitchen users		X	X	X	X	X	X	X	X
Menu-planning with new production systems	X	X	X	X	X	X	X	X	X
Budgeting for more organic food within previous budget		X	X	X	X	X	X	X	X
Food-waste lessons on re-use of leftovers		X	X	X	X	X	X	X	X
Fieldtrips for kitchen employees to farms and producers	X			X	X	X		X	X
Network between/among kitchens, suppliers and producers	X	X	X	X	X	X	X	X	X
Organic Cuisine Label method introduction and application	X	X	X	X	X	X	X	X	X
Follow-up visit offers to individual kitchen participants			X				X		

Managing institution: 1, 3, 5, 7 and 8) Producer Association; 2, 6 and 9) Audit, Accounting and Counselling Company; 4) University

Paper III

Wellbeing at work among kitchen workers during organic food conversion in Danish public kitchens: a longitudinal survey

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Wellbeing at work among kitchen workers during organic food conversion in Danish public kitchens: a longitudinal survey

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Background: In 2011, the Danish Ministry of Food, Agriculture and Fisheries launched the Danish Organic Action Plan 2020 intending to double the organic agricultural area in Denmark. This study aims to measure experienced physical and psychological wellbeing at work along with beliefs and attitudes among kitchen workers before and after participating in educational training programmes in organic food conversion. **Method:** This longitudinal study applied an online self-administered questionnaire among kitchen workers before and after the implementation of an organic food conversion programme with 1-year follow-up. The study targeted all staff members in the participating public kitchens taking part in the organic food conversion process funded by the Danish Organic Action Plan 2020. **Results:** Of the 448 eligible kitchen workers, 235 completed the questionnaire at baseline (52%) and 149 at follow-up (63% of those surveyed at baseline). No substantive differences between baseline and follow-up measurements of organic food conversion were detected on physical or psychological wellbeing at work. Kitchen workers reported a significant improvement in the perceived food quality, motivation to work and application of nutritional guidelines. Reported organic food percentages for the kitchens also increased significantly ($P < 0.001$) and a shift from using ready-made food products to producing more food from base was indicated. **Conclusion:** Within 1 year, a significant increase in motivation to work among kitchen staff was observed with no substantive changes in physical or psychological wellbeing at work identified. The results support the Danish Organic Action Plan 2020 and initiatives of similar kind.

Introduction

In line with the ambition behind the Action Plan for the future Organic Production in the European Union,¹ the Danish Ministry of Food, Agriculture and Fisheries launched the Danish Organic Action Plan 2020 in 2011.² The intention of the Danish Organic Action Plan 2020 is to double the organic agricultural area in Denmark and improve sustainability, biodiversity and animal welfare^{3–5} by stimulating the demand for organic agriculture through increased public procurement of organic foods.^{2,6} Therefore, organic food conversion projects meaning to educate and develop the skillset among kitchen workers in Danish public kitchens within organic food production continue to receive funding.⁶

The educational components in the organic food conversion projects funded by the Danish Organic Action Plan 2020 included training of the kitchen employees in planning menu-plans based on organic local and seasonal food products with legumes rather than meat, using and re-using all possible food elements and focusing on meals produced from base rather than convenience products.^{7,8} Hence, implementing organic food procurement within the same budget requires transformation of public kitchen systems.⁹ This may pose challenges to kitchen workers in terms of changes in the food supply, premium prices of organic foods and the extra workload required for menu-planning and food preparation as a result of decreased use of convenience foods.⁷ Many public kitchens already have tight timelines and limited resources with which to meet strict nutritional recommendations and new coping mechanisms may therefore be required,^{7,9} which can adversely affect

physical wellbeing through changes to posture, force, repetition and duration.^{10–13} Psychological wellbeing among kitchen workers may also be adversely affected during organic food conversion unless job-control is balanced and burnout prevented.¹⁴ The importance of establishing a sense of ownership of the change process among kitchen workers has therefore been emphasized to achieve a successful transition.¹⁵ The actual effects of organic food conversion on public kitchen workers' wellbeing remain, however, unknown.

The aim of this study is to measure experienced physical and psychological wellbeing among kitchen workers before and after organic food conversion in public kitchens participating in the Danish Organic Action Plan 2020. Additionally, potential differences on the beliefs and attitudes of the kitchen workers in relation to the organic food conversion process will be explored.

Methods

Survey design

This was a longitudinal study applying an online self-administered questionnaire on physical and psychological wellbeing at work among kitchen workers in Danish public kitchens during an organic food conversion programme. Measurements were collected before and after the implementation of the conversion programme with baseline measurements in September 2013 and follow-up measurements 1 year later. The study was performed in accordance with the ethical standards of the Helsinki Declaration of 1975, as revised in 2008.¹⁶

Public kitchens and recruitment of study participants

Four organic food conversion projects received funding from the Danish Organic Action Plan 2020 in the spring of 2013. These projects sought to implement organic food conversion in 170 public kitchens employing 448 kitchen workers across Denmark. Kitchens were classified as childcare, school, after-school, canteen, elderly, hospital, central or residential institution according to already established categories developed by the Danish Diet and Nutrition Association.¹⁷ The number of kitchen workers employed in each kitchen was recorded as were the numbers of kitchens offering breakfast, lunch, dinner and in-between meals. For each kitchen, every staff member assisting in food preparation who potentially would be involved in the organic food conversion process was invited to participate. At baseline and follow-up, kitchen workers were invited directly by email or else through contact with other staff at the institution or project managers in charge of implementing the conversion. Informed consent was obtained by email before forwarding the questionnaire.

Data collection

Data were collected through the completion of an on-line self-administered questionnaire. The questionnaire was anonymous and included comment fields allowing respondents to provide additional information if they wished to. The online questionnaire included a total of 25 questions divided into background information, psychological wellbeing at work, physical wellbeing at work, beliefs and attitudes and extent of organic food conversion. The questions in the first three sections were derived from established and internationally validated questionnaires^{17–19} and the questions in the two final sections were developed specifically for this project through field visits and pilot-testing in a sample of three childcare kitchens, three elderly care kitchens and one canteen kitchen. The background section included questions on age and gender of the kitchen worker, years of experience in the workplace, type of kitchen employed in and number of colleagues in the kitchen workplace.

All measurements were made in the same fashion at baseline and follow-up except for four questions on the personal considerations of the kitchen workers in relation to the organic food conversion process which were only recorded at the follow-up visit.

Outcomes

The psychological working environment was measured as 12 dimensions: quantitative demands, tempo (work pace), emotional demands, influence at work, possibilities for development, meaning of work, commitment to the workplace, predictability, rewards (recognition), role clarity, 'vertical trust' (between management and employees) and justice and respect. Each dimension was evaluated by two questions, each of which had five possible responses (0–4 on an ordinal scale). The physical working environment was measured as six dimensions with one question in each. The questions included self-rated physical fatigue after a normal day of work in back, neck, shoulder, arms, wrists and legs, with similar 0–4 ordinal scale response options for each question.

To complement measures of psychological and physical wellbeing, kitchen workers were asked about their beliefs and attitudes towards the food quality, experiences with kitchen user recognition, motivation to work, application of nutritional guidelines and food flavouring practices at baseline and follow-up. In addition, four questions were added to the follow-up measurement directly asking the kitchen workers to consider their experiences with the organic food conversion process in relation to their work satisfaction, joy and workload, all with five response options for each question.

The extent of organic food conversion was defined as the proportion of food estimated to be organic by the kitchen

workers. During the organic food conversion, public kitchens mainly applied the official Danish Organic Cuisine Label method^{8,20} to register the proportion of organic food within one of the four intervals: 0–30% (no label), 30–60% (bronze label), 60–90% (silver label) and 90–100% (gold label). The amount of processed food products was also measured as a possible indicator of the conversion process.

Analysis

Primary analyses were based upon all responses obtained at baseline and all responses obtained at follow-up (unpaired). A secondary set of analyses were restricted to only those individuals with data obtained at both baseline and follow-up (paired). For the physical and psychological measures of wellbeing, the ordinal responses were treated as continuous variables and the mean values were estimated at baseline and follow-up and differences in the mean and 95% CI between baseline and follow-up were also calculated. Tests of difference between baseline and follow-up were made using unpaired *t*-tests for the primary analysis and paired *t*-tests for the secondary analysis. Where the data were proportions the comparisons were made using chi-squared tests.

Differences in organic food percentage following the organic food conversion programme were estimated by comparing the reported proportions within the different intervals relevant for the Organic Cuisine Label (0–30%, 30–60%, 60–90% and 90–100%). In addition the baseline metrics and the questions relating to the kitchen workers' views on the transition that were recorded only at follow-up were summarised as proportions.

Given the large number of comparisons made, and in an effort to limit the risk of drawing false-positive conclusions, a *P* value of 0.01 was considered significant and the findings were interpreted in light of the broad pattern of observations recorded rather than single findings being considered in isolation. *T*-tests and chi-squared statistical analyses were done using RStudio statistical software package version 0.98.1103 (R Inc., Boston, MA).

Results

Of the 170 public kitchens from which kitchen workers were invited to participate, 83 were represented at baseline (49%) and 71 at follow-up (86% of those surveyed at baseline). More than half of the public kitchens included at baseline were childcare kitchens (58%) followed by residential institutions (14%), canteens (12%) and elderly care kitchens (6%). School and hospital kitchens were each represented by 4% of the participating public kitchens while after-school and central kitchens each were represented by 1% (table 1). In terms of meals produced, 76% of the public kitchens included at baseline reported preparing breakfast, 98% lunch, 27% dinner and 87% in-between meals. The proportions of different kitchen types included at follow-up and the types of meals produced were not significantly different from baseline. Of the 87 eligible public kitchens not included, 84% were childcare kitchens.

Of the 448 eligible kitchen workers, 235 completed the questionnaire at baseline (52%) and 149 at follow-up (63% of those surveyed at baseline). The majority of the participants were female and aged 40–49 years (table 2). Most participants had been working in the kitchen workplace for 1–4 years (32%) as an employee (58%), and at either a hospital (31%) or a childcare kitchen (23%). Participants surveyed at follow-up were similar to those included at baseline.

Primary analysis

For the primary unpaired analysis presented in table 3, there were no significant differences between baseline and follow-up measures of psychological wellbeing. In terms of the six parameters measuring physical wellbeing, there were no significant differences observed except for general body fatigue. Here, the follow-up score was

Table 1 Characteristics of public kitchens included in the study at baseline ($n=83$) and follow-up ($n=71$)

Characteristics	Baseline (%)	Follow-up (%)
Kitchen type^a		
Childcare	58	56
School	4	4
After-school	1	1
Canteen	12	14
Elderly	6	7
Hospital	4	4
Central	1	1
Residential	14	11
Kitchens producing main meals^b		
Breakfast	76	75
Lunch	98	97
Dinner	27	27
Kitchens producing in-between meals^c	87	82

a: Childcare includes all childcare institutions such as nurseries, kindergartens and integrated institutions; School includes school canteens and school-cooking classes; After-school covers institutional after-school care; Canteen includes canteens or cafés associated with workplaces, universities, activity centres or cultural venues; Elderly includes homes for elderly; Hospital covers patient procurement; Central includes large-scale food production kitchens delivering procurement for receiving kitchens; Residential includes institutions in which consumers live permanently (i.e. social care facilities, university boarding schools and barracks).

b: Proportions of kitchens producing breakfast, lunch and dinner, self-reported. Kitchen types open for production 5 d/week: childcare, school food, after-school and canteen. Institution types open 7 d/week: elderly, hospital, central and residential.

c: Proportions of kitchens producing in-between meals, self-reported. Kitchen types open 5 d/week: childcare, school, after-school and canteen. Institution types open 7 d/week: elderly, hospital, central and residential.

significantly ($P=0.004$) higher than the baseline score with a difference in mean (95% CI) of 0.32 (0.11, 0.53). Significantly higher scores from baseline to follow-up were also identified in three parameters measuring beliefs and attitudes including perceived food quality ($P<0.001$), motivation to work with organic food production ($P=0.01$) and application of nutritional guidelines in food production ($P<0.001$) with differences in means (95% CI) of 0.25 (0.41, 0.35), 0.22 (0.05, 0.39) and 0.56 (0.37, 0.76), respectively.

Self-rated organic food percentage was reported according to the levels of the Organic Cuisine Label. At baseline 144 (61%) participants reported a procurement level between 0 and 30%, which is below the lowest level required to be awarded an Organic Cuisine Label. The number of participants reporting an organic food percentage between 30 and 60% (bronze) at baseline was 39 (17%), 26 (11%) reported a percentage at 60–90% (silver) and 5 (2%) at 90–100% (gold). At baseline 21 (9%) participants reported not knowing the level of organic food procurement in their kitchen. At follow-up the number of participants reporting not knowing the level of organic food procurement had significantly decreased to 4 (2.5%) and the proportion of participants reporting organic food percentage had shifted towards higher levels: 31.5% at the 0–30% level, 25.5% at bronze level, 31.5% at silver level and 9% at gold level. The increase in organic food percentage was significant ($P<0.001$) with a difference in means (95% CI) of 0.68 (0.49, 0.88). Measurements of the production methods of selected foods indicated a shift from applying more ready-made food products at baseline to more food being produced from base at follow-up (Supplementary table S1). This effect was significant for one food item (Pâté, $P=0.004$).

Table 2 Characteristics of kitchen workers included in the study at baseline ($n=235$) and follow-up ($n=149$)

Characteristics	Baseline (%)	Follow-up (%)	P value ^a
Age (years)			0.818
<30	9	7	
30–39	19	19	
40–49	39	37	
50–59	29	34	
>60	4	3	
Gender			0.197
Female	79	86	
Male	8	6	
Unknown ^b	13	8	
Experience (years)^c			0.077
<1	11	3	
1–4	32	33	
5–9	26	34	
10–14	13	14	
15–20	7	4	
>20	11	12	
Position^d			0.192
Leader	28	36	
Employee	58	56	
Trainee	14	8	
Workplace^e			0.480
Childcare	23	32	
School	3	3	
After-school	1	1	
Canteen	16	12	
Elderly	9	13	
Hospital	31	26	
Central	3	2	
Residential	14	11	

a: χ^2 statistical test for proportions.

b: Proportion of respondents for who gender could not be established.

c: Number of years the respondent has been working in the respective kitchen.

d: Work position of the respondent in the respective kitchen.

e: Workplace of the respondent in terms of kitchen type.

Kitchen workers' considerations on the recent organic food conversion process are presented in Table 4. Half of the kitchen workers (50%) reported that the conversion process had had a positive/very positive impact on their job satisfaction whereas 44% reported no change. Similar numbers were reported with regard to joy with work and motivation to work, 53% and 54% reported positive/very positive impact, respectively, and 41% and 36% reported no change, respectively. Finally for workload, 24% reported positive/very positive impact and 60% no change.

Secondary analysis

The results from the secondary paired analysis ($n=92$) were similar to the primary analysis with only a few differences. Of the parameters measuring psychological wellbeing, a borderline significant decrease in scores was detected in 'Influence' and 'Recognition (rewards)' at $P=0.04$ with a difference in mean (95% CI) of -0.33 ($-0.63, -0.02$) and $P=0.03$ with a difference in mean of -0.29 ($-0.56, -0.03$) respectively (Supplementary table S2). In terms of physical wellbeing, the significant increase in scores for general body fatigue was not found but a significant negative difference on self-rated physical work ability was detected at $P=0.01$ with a difference in mean (95% CI) of -0.24 ($-0.42, -0.06$) (Supplementary table S2). Of the three significant differences between baseline and follow-up measurements of the parameters measuring beliefs and attitudes identified in the primary analysis, only the increase in scores for food quality was still significant ($P=0.01$) with a difference in mean (95% CI) of 0.14 (0.04, 0.24) (Supplementary table S2).

Table 3 Changes in parameters on psychological and physical wellbeing at work and beliefs and attitudes amongst kitchen workers during organic food conversion at baseline ($n=235$) and follow-up ($n=149$)

Parameters	Baseline		Follow-up		Difference	P values
Psychological ^a	Mean	SD	Mean	SD	Mean (95%CI)	T-test ^b
Quantitative demands	3.8	(0.9)	4.0	(0.8)	0.15 (−0.02,0.33)	0.096
Work pace	3.2	(1.2)	3.0	(1.5)	−0.20 (−0.48,0.07)	0.147
Emotional demands	4.9	(1.5)	4.8	(1.7)	−0.15 (−0.47,0.18)	0.379
Influence	5.4	(1.8)	5.3	(1.8)	−0.09 (−0.46,0.29)	0.650
Possibilities for development	5.8	(1.4)	5.9	(1.3)	0.14 (−0.14,0.41)	0.336
Meaning of work	6.5	(1.1)	6.7	(1.1)	0.18 (−0.05,0.41)	0.117
Commitment to the workplace	5.6	(1.4)	5.6	(1.6)	0.01 (−0.30,0.32)	0.942
Predictability	5.1	(1.4)	5.2	(1.5)	0.05 (−0.25,0.35)	0.725
Rewards (recognition)	5.8	(1.3)	5.6	(1.6)	−0.12 (−0.41,0.17)	0.424
Role clarity	6.1	(1.2)	6.0	(1.4)	−0.05 (−0.32,0.21)	0.681
Trust regarding management	6.0	(1.3)	5.9	(1.5)	−0.04 (−0.33,0.24)	0.772
Justice and respect	5.1	(1.3)	5.1	(1.5)	−0.03 (−0.31,0.26)	0.855
Physical						
Body fatigue (general)	2.1	(1.1)	2.4	(0.9)	0.32 (0.10,0.54)	0.004
Back fatigue	2.4	(1.2)	2.6	(1.1)	0.20 (−0.04,0.44)	0.100
Neck and shoulder fatigue	2.3	(1.2)	2.5	(1.1)	0.23 (−0.01,0.47)	0.064
Arm and wrist fatigue	2.6	(1.3)	2.8	(1.1)	0.22 (−0.03,0.46)	0.084
Leg fatigue	2.5	(1.3)	2.7	(1.1)	0.20 (−0.04,0.50)	0.106
Self-rated physical work ability	2.8	(0.9)	2.7	(1.0)	−0.16 (−0.35,0.03)	0.089
Beliefs and attitudes						
The food quality is good	3.5	(0.6)	3.8	(0.4)	0.25 (0.13,0.26)	<0.001
Motivation to work	3.1	(0.9)	3.3	(0.8)	0.22 (0.05,0.40)	0.012
Kitchen user recognition	3.4	(0.6)	3.4	(0.7)	0.02 (−0.11,0.14)	0.811
Nutritional guideline application	2.7	(1.1)	3.3	(0.8)	0.56 (0.36,0.77)	<0.001
Food flavouring before serving	3.7	(0.5)	3.7	(0.5)	0.07 (−0.04,0.17)	0.230

a: Psychological scales/parameters included two dimensions per scale whereas physical and emotional scales/parameters only included one dimension. Dimensions were scored from 0 to 4 where high scores in all scales/parameters indicate beneficial/positive development.

b: Unpaired, two-sided t-test.

Table 4 Considerations by kitchen workers on the impact of organic conversion process in four areas at follow-up ($n=149$)

Answer options	Job satisfaction (%)	Joy with work (%)	Motivation to work (%)	Workload (%)
Very positively	20	17	18	3
Positively	30	36	36	21
No change	44	41	36	60
Negatively	1	1	4	8
Very negatively	0	0	0	1
Unknown	5	5	5	7

Discussion

This study showed no significant negative differences in the psychological or physical wellbeing of kitchen workers following the organic food conversion but significant positive changes were detected in reported beliefs and attitudes in terms of perceived food quality, motivation to work and application of nutritional guidelines. These results are supported by the reported considerations of the kitchen workers, where half or more reported experiencing a positive/very positive impact of the organic food conversion process on their job satisfaction, joy with work and motivation. Finally, results show a significant shift towards higher reported organic food percentages.

The present results suggest that despite of additional job demands associated with implementing organic food conversion, Danish public kitchen workers experience greater job satisfaction and motivation to work. The results indicate that it is possible to increase the organic food percentage in Danish public kitchens while avoiding negative changes in the experienced wellbeing at work through training, at least during the first year. Results from

this study are supported by recent research on implementing whole school food programmes, during which kitchen worker involvement resulted in greater motivation and job satisfaction despite new challenges.²¹ Former research on food service employees also found that stress from additional job demands can be balanced by job-control and support from managers.¹⁴ With none of the funding from the Danish Organic Action Plan 2020 being available to cover additional costs of purchasing organic food products, crucial success criteria for the organic food conversion projects is to increase the knowledge of organic food among kitchen employees and their motivation to prioritize it.¹⁵ Through training on practical food preparation and application of organic food production systems, organic food conversion projects seem to upgrade the professional competencies of the kitchen employees, resulting in increased empowerment and wellbeing at work.

Viewing the results from a broader perspective, the present findings suggest that organic food conversion in public kitchens holds potential to improve the sustainability of the public food production. Generally, the educational content of conversion projects emphasises strategies to increase organic, local and seasonal procurement, reduce food waste and limit meat consumption. These strategies are effectively implemented to cover the price premium of organic food and are also strongly linked to increased sustainability.^{7,8,22} Moreover, Danish public kitchens spent 400 million DDK (~53.6 million Euro) on organic food procurement in 2013.²³ With the potential to increase the demand for organic produce, organic food conversion may impact environmental sustainability in terms of soil quality, water conservation, biodiversity, limiting application of antibacterial regimes and greenhouse gas emissions.^{3,4} Adding to this the implications of potential transferability suggested by former studies,²¹ organic food conversion may be of great relevance to other countries than Denmark in terms of sustainable food production in the future.

Regarding physical wellbeing at work measurements, the differences obtained demonstrate how physical wellbeing can be kitchen dependent with some kitchens being able to adjust and upgrade the physical kitchen facilities to meet potential additional needs of the kitchen workers. They also illustrate how motivated kitchen workers pay less attention to the potentially increased physical workloads (primary analysis) or reversely, how additional challenges may decrease perceived work ability (secondary analysis).

This study has several limitations. The relatively small sample size in terms of public kitchens and kitchen workers included resulted in limited statistical power to detect small differences in study outcomes. The study did not include control kitchens and workers that were not exposed to the organic food conversion process and is therefore unable to directly inform causality. The characteristics of the kitchen workers mirrored those of kitchen worker from a previous Danish study²⁴ and were not significantly different from baseline to follow-up, but the risk of introducing participant loss to follow-up bias cannot be excluded. Similarly, response bias can also not be excluded due to the self-administered questionnaire design. The relatively large number of participants working in a hospital kitchen can be explained by the number of workers needed in a hospital kitchen, whereas childcare kitchens often only have one or two kitchen workers employed. Finally, improvements to the data collection process should be made to avoid unknown gender specifications of the participants. This question was not sufficiently integrated in the online questionnaire design and therefore gender could not be determined in a small sample of the participants.

Nonetheless, the exploratory value of this study should be emphasized. To the best of the authors' knowledge, this is the first time wellbeing at work has been reported among kitchen workers in public kitchens during organic food conversion and complementary studies on the long-term effects are needed. The questionnaire design combined three existing questionnaires^{17–19} with sections constructed by the authors specifically for this study, which has been done before.²⁵ However, the level of validation of the different questionnaire sections in this study varies greatly with the Copenhagen Psychosocial Questionnaire being recognized and applied internationally^{26–30} and the author-constructed part having been developed through expert advice and pilot-testing among the target population.

In conclusion, this study found no substantive differences on either physical or psychological wellbeing at work among kitchen workers before and after organic food conversion but did find significant increases in experienced motivation to work and perceived food quality. This may add to the benefits of increasing organic public procurement by showing potential improvements to kitchen worker beliefs and attitudes. The results from this study support the Danish Organic Action Plan 2020 and initiatives of similar kind.

Supplementary data

Supplementary data are available at *EURPUB* online.

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Conflicts of interest: None declared.

Key points

- This study found no substantive differences on experienced physical or psychological wellbeing at work among kitchen workers before and after organic food conversion in Danish public kitchens
- Results from this study indicate increases in experienced motivation to work and perceived food quality by kitchen workers as well as an overall increase in organic food percentage in the public kitchens following organic food conversion.
- Policy implications following this study could include more targeted support for the Danish Organic Action Plan 2020 and similar initiatives along with additional research on the potential positive effects of organic food conversion in terms of nutrition and food quality.

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Supplemental material

Supplement Table 1. Production methods of selected food products by the participating kitchens in the study at baseline (n=235) and follow-up (n=149) measurements.

Food products	Produced from raw products (%) ^a		Produced from semi-readymade products (%) ^b		Readymade products used (%) ^c		Not produced by the kitchen (%)		Unknown (%)		P-value ^d
	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	Baseline	Follow-up	
White bread	60	73	9	8	25	15	3	3	5	1	0.042
Wholegrain bread	5	11	20	19	69	66	1	3	5	1	0.088
Prepared vegetables	77	85	14	7	5	6	1	1	3	0	0.154
Cooked dishes	90	95	5	3	0	0	1	1	4	0	0.369
Meat toppings	9	13	18	16	62	58	4	9	6	4	0.186
Pâté	8	17	8	12	77	66	3	3	4	1	0.004
Sandwich fillings	53	62	15	8	24	25	3	4	5	1	0.081
Cakes and cookies	59	63	6	7	15	9	11	12	9	9	0.569
Meat cuts	30	26	14	11	41	48	5	4	10	11	0.720

^aIncludes preparing the food products from raw products exclusively.

^bIncludes preparing the food products partly from processed products such as bread mixes and powdered soups.

^dChi² statistical test for proportions.

Supplement Table 2. Changes in parameters on psychological and physical wellbeing at work and beliefs and attitudes amongst kitchen workers during organic food conversion (paired measurements, n=92).

Scales	Baseline		Follow-up		Difference	P-value
Psychological^a	Mean	SD	Mean	SD	Mean (95%CI)	T-test^b
Quantitative demands	3.9	(0.8)	4.0	(0.8)	0.14 (-0.07,0.35)	0.184
Work pace	3.1	(1.3)	2.9	(1.5)	-0.13 (-0.38,0.12)	0.310
Emotional demands	5.0	(1.5)	4.8	(1.6)	-0.17 (-0.44,0.10)	0.205
Influence	5.8	(1.8)	5.4	(1.8)	-0.33 (-0.63,-0.02)	0.039
Possibilities for development	5.9	(1.3)	6.0	(1.3)	0.05 (-0.19,0.29)	0.649
Meaning of work	6.7	(1.1)	6.7	(1.1)	0.05 (-0.15,0.25)	0.586
Commitment to the workplace	5.6	(1.4)	5.6	(1.6)	-0.05 (-0.33,0.23)	0.699
Predictability	5.0	(1.4)	4.9	(1.6)	-0.12 (-0.39,0.15)	0.374
Rewards (recognition)	5.8	(1.4)	5.5	(1.6)	-0.29 (-0.56,-0.03)	0.030
Role clarity	6.0	(1.1)	5.8	(1.6)	-0.20 (-0.51,0.11)	0.214
Trust regarding management	5.9	(1.3)	5.7	(1.5)	-0.26 (-0.57,0.05)	0.103
Justice and respect	5.2	(1.3)	5.0	(1.5)	-0.24 (-0.56,0.08)	0.139
Physical						
Body fatigue (general)	2.3	(0.9)	2.3	(1.0)	0.04 (-0.13,0.22)	0.625
Back fatigue	2.6	(1.0)	2.6	(1.1)	-0.03 (-0.23,0.17)	0.750
Neck and shoulder fatigue	2.5	(1.0)	2.4	(1.1)	-0.03 (-0.24,0.18)	0.758
Arm and wrist fatigue	2.7	(1.0)	2.8	(1.2)	0.03 (-0.20,0.26)	0.780
Leg fatigue	2.5	(1.1)	2.6	(1.1)	0.11 (-0.08,0.30)	0.247
Self-rated physical work ability	2.8	(0.9)	2.6	(1.1)	-0.24 (-0.42,-0.06)	0.010
Beliefs and attitudes						
The food quality is good	3.6	(0.5)	3.8	(0.4)	0.14 (0.04,0.24)	0.006
Motivation to work	3.5	(0.6)	3.4	(0.6)	0.20 (0.04,0.36)	0.017
Kitchen user recognition	3.5	(0.6)	3.3	(0.7)	-0.14 (-0.28,0.01)	0.064
Nutritional guideline application	3.2	(0.9)	3.2	(0.9)	0.05 (-0.13,0.24)	0.567
Food flavouring before serving	3.8	(0.4)	3.7	(0.5)	-0.08 (-0.18,0.03)	0.163

^aPsychological scales/parameters included two dimensions per scale whereas physical and emotional scales/parameters only included one dimension. Dimensions were scored from 0-4 where high scores in all scales/parameters indicate beneficial/positive development.

^bPaired, 2-sided t-test.

Questionnaire on wellbeing at work [in Danish]

Exported online from the LimeSurvey survey setup

Applied in Paper III

Spørgeskema om arbejdstrivsel i offentlige køkkener under en økologiomlægning - slutmåling

Formålet med dette spørgeskema er at afslutte undersøgelsen af arbejdsrutinerne og trivslen blandt køkkenmedarbejdere i offentlige køkkener under en økologiomlægning. Din besvarelse af spørgeskemaet er vigtig for undersøgelsen af økologiprojektet og vil bidrage til en forhåbentlig endnu bedre kostforplejning for både brugere og medarbejdere i fremtiden. Spørgeskemaet indeholder spørgsmål om både det fysiske og psykiske arbejdsmiljø. Nogle af spørgsmålene vil måske ikke passe direkte på din arbejdsplads, men det er vigtigt at du besvarer alle spørgsmålene så godt som muligt for at sikre en høj kvalitet i undersøgelsen. TAK for din indsats!

Spørgsmålene i skemaet besvares ved at vælge én af svarmulighederne, med mindre andet er angivet. Det tager ca. 15-20 min i alt at besvare alle spørgsmål. Besvar venligst alle spørgsmål og tryk "send" når du er færdig.

Du er velkommen til at kontakte projektmedarbejder Andreas Borch hvis du er i tvivl om noget angående skemaet på denne mailadresse: anborc@food.dtu.dk eller på telefon: 35 88 71 56.

Fortrolighed: spørgeskemaet er anonymt og alle oplysninger vil blive behandlet fortroligt. Din besvarelse vil udelukkende blive brugt i forskningsmæssig sammenhæng og på en sådan måde at du ikke kan identificeres i resultaterne.

Spørgeskemaet indeholder 25 spørgsmål.

Baggrund

[]Hvor gammel er du? *

Vælg én af følgende mulige svar:

- ☐ Under 30 år
- ☐ 30-39 år
- ☐ 40-49 år
- ☐ 50-59 år
- ☐ 60 år eller mere

[]Hvor længe har du været ansat på din nuværende arbejdsplads? *

Vælg én af følgende mulige svar:

- ☐ Under 1 år
- ☐ 1-4 år
- ☐ 5-9 år
- ☐ 10-14 år
- ☐ 15-20 år
- ☐ Over 20 år

[]Er du ansat som... *

Vælg én af følgende mulige svar:

- ☐ Cheføkonoma?
- ☐ Souschef?
- ☐ Køkkenleder?
- ☐ Økonoma (-assistent)?
- ☐ Køkkenassistent?
- ☐ Husassistent/køkkenmedhjælper?
- ☐ Elev?
- ☐ Andet? (skriv venligst i kommentar-feltet)

Kommentar til dit valg skrives her:

[]Hvor i landet er din arbejdsplads placeret? *

Skriv dit svar her:

Skriv by (f.eks. Århus) og postnummer

[]Hvor mange ansatte er der i det køkken, hvor du er ansat? *

Vælg én af følgende mulige svar:

- ☐ 1 ansat (kun mig selv)
- ☐ 2-4 ansatte
- ☐ 5-9 ansatte
- ☐ 10-25 ansatte
- ☐ 26 eller flere ansatte

[]Hvilken type arbejdsplads er du ansat på? *

Vælg én af følgende mulige svar:

- ☐ Plejehjem/ældrecenter/aktivitetscenter o.l.
- ☐ Hospitalskantine (bespisning af gæster og ansatte)
- ☐ Hospitalskøkken (bespisning af patienter)
- ☐ Vuggestue/børnehave/integreret institution
- ☐ Døgninstitution/bo enhed o.l.
- ☐ Selvstændigt køkken/centralkøkken o.l.
- ☐ Højskole, kursuscenter eller anden uddannelsesinstitution (universitet)
- ☐ Fængselsvæsenet
- ☐ Kaserne
- ☐ Arbejdspladskantine
- ☐ Skolekantine
- ☐ Andet (skriv venligst i kommentar-feltet)

Kommentar til dit valg skrives her:

[]Hvilke typer måltider fremstilles i køkkenet? *

Vælg én eller flere:

- ☐ Morgenmad
- ☐ Aftensmad
- ☐ Frokost
- ☐ Mellemmåltider
- ☐ Anden servering

Psyisk arbejdsmiljø

[] *

Vælg ét svar for hvert element:

	Altid	Ofte	Sommetider	Sjældent	Aldrig/næsten aldrig
Bringer dit arbejde dig i følelsesmæssigt belastende situationer?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har du stor indflydelse på beslutninger om dit arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er det nødvendigt at arbejde meget hurtigt?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Skal du tage stilling til andre menneskers personlige problemer i dit arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kommer du bagud med dit arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har du tid nok til dine arbejdsopgaver?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har du indflydelse på mængden af dit arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[] *

Vælg ét svar for hvert element:

	I meget høj grad	I høj grad	Delvist	I ringe grad	I meget ringe grad
Kræver dit arbejde, at du er initiativrig?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er dine arbejdsopgaver meningsfulde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Får du på din arbejdsplads information om f.eks. vigtige beslutninger, ændringer og fremtidsplaner i god tid?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er der klare mål for dit eget arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bliver dit arbejde anerkendt og nåskønnet af	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Udsagnen om ledelsen?	1	2	3	4	5
Bliver konflikter løst på en retfærdig måde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Føler du, at du yder en vigtig arbejdsindsats?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ville du anbefale en god ven at søge en stilling på din arbejdsplads?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Får du al den information, du behøver for at klare dit arbejde godt?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bliver du behandlet retfærdigt på din arbejdsplads?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ved du nøjagtigt, hvad der forventes af dig i dit arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Har du mulighed for at lære noget nyt gennem dit arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Er arbejdstempoet højt gennem hele arbejdsdagen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bliver arbejdsopgaverne fordelt på en retfærdig måde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Synes du, at din arbejdsplads har stor personlig betydning for dig?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stoler ledelsen på at medarbejderne gør et godt stykke arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kan man stole på de udmeldinger der kommer fra ledelsen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Fysisk arbejdsmiljø

[] Hvor fysisk træt er du efter en typisk arbejdsdag? *

Vælg ét svar for hvert element:

	Ikke træt	Lidt træt	Noget træt	Meget træt	Helt udmattet
I kroppen generelt?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I ryggen?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I nakken/skuldrene?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I arme/håndled?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I benene?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[] Arbejdsevne *

Vælg ét svar for hvert element:

	Fremragende	Særdeles god	God	Nogenlunde	Dårlig
Hvordan vurderer du din nuværende arbejdsevne i forhold til de <i>fysiske</i> krav i dit arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hvordan vurderer du din nuværende arbejdsevne i forhold til de <i>mentale</i> krav i dit arbejde?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[] Hvis du tænker på dit helbred, tror du så, at du er i stand til at udføre dit job om 2 år? *

Vælg én af følgende mulige svar:

- ☐ Nej, helt utænkeligt
- ☐ Nej, sandsynligvis ikke
- ☐ Ja, sandsynligvis
- ☐ Ja, helt sikkert

Arbejdspladsen

[] Har der på din arbejdsplads inden for de seneste par år været gennemført væsentlige ændringer, f.eks. som følge af nedskæringer, rationalisering, sammenlægning, udlicitering, nyt arbejdsgiversforhold, helt ny produktionsform eller økologiomlægning? *

Vælg én af følgende mulige svar:

- ☐ Ja (skriv hvilken af ændringerne der er tale om i kommentar-feltet)
- ☐ Nej, men der er aktuelle planer/diskussioner herom
- ☐ Nej
- ☐ Ved ikke, er forholdsvis ny på arbejdspladsen

Kommentar til dit valg skrives her:

HUSK at specificere hvilken af ovenstående ændringer der er tale om!

[] Hvad var din holdning til forandringen, inden den blev besluttet? *

Svar kun på dette spørgsmål, hvis følgende betingelse(r) er opfyldt:

Svaret var 'Ja (skriv hvilken af ændringerne der er tale om i kommentar-feltet)' ved spørgsmål '13 [ændringer]' (Har der på din arbejdsplads inden for de seneste par år været gennemført væsentlige ændringer, f.eks. som følge af nedskæringer, rationalisering, sammenlægning, udlicitering, nyt arbejdsgiversforhold, helt ny produktionsform eller økologiomlægning?)

Vælg én af følgende mulige svar:

- ☐ Jeg var alt overvejende for planerne
- ☐ Jeg var alt overvejende imod planerne
- ☐ Jeg var hverken for eller imod planerne
- ☐ Ved ikke

[] Har din holdning til forandringen ændret sig, efter den er blevet gennemført? *

Svar kun på dette spørgsmål, hvis følgende betingelse(r) er opfyldt:

Svaret var 'Ja (skriv hvilken af ændringerne der er tale om i kommentar-feltet)' ved spørgsmål '13 [ndringer]' (Har der på din arbejdsplads inden for de seneste par år været gennemført væsentlige ændringer, f.eks. som følge af nedskæringer, rationalisering, sammenlægning, udlicitering, nyt arbejdsgiversforhold, helt ny produktionsform eller økologiomlægning?)

Vælg én af følgende mulige svar:

- ☐ Ja, jeg er blevet mere positiv over for forandringen
- ☐ Ja, jeg er blevet mere skeptisk over for forandringen
- ☐ Min holdning er uændret
- ☐ Ved ikke

[] Hvad mener du generelt om dine arbejdsforhold, efter at forandringen er blevet gennemført? *

Svar kun på dette spørgsmål, hvis følgende betingelse(r) er opfyldt:

Svaret var 'Ja (skriv hvilken af ændringerne der er tale om i kommentar-feltet)' ved spørgsmål '13 [ndringer]' (Har der på din arbejdsplads inden for de seneste par år været gennemført væsentlige ændringer, f.eks. som følge af nedskæringer, rationalisering, sammenlægning, udlicitering, nyt arbejdsgiversforhold, helt ny produktionsform eller økologiomlægning?)

Vælg én af følgende mulige svar:

- ☐ Er bedre end før
- ☐ Er uændrede
- ☐ Er blevet værre end før
- ☐ Ved ikke

[] Har du det seneste år deltaget i kurser/efteruddannelse i relation til dit arbejde? *

Vælg én af følgende mulige svar:

- ☐ Nej
- ☐ Ja, i op til 1 uge
- ☐ Ja, i 1 til 2 uger
- ☐ Ja, i mere end 2 uger

[] I hvilken grad omhandlede de kurser/efteruddannelse du deltog i, følgende? *

Svar kun på dette spørgsmål, hvis følgende betingelse(r) er opfyldt:

Svaret var 'Ja, i op til 1 uge' *eller* 'Ja, i 1 til 2 uger' *eller* 'Ja, i mere end 2 uger' ved spørgsmål '17 [Efteruddannelse]' (Har du det seneste år deltaget i kurser/efteruddannelse i relation til dit arbejde?)

Vælg ét svar for hvert element:

	Ja, i høj grad	Ja, i nogen grad	Kun i ringe grad	Slet ikke
Økologi	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ernæringsrigtig kost	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Betjening af redskaber, maskiner og anden teknologi i køkkenet?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
EDB	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nye produktionsformer (f.eks. frost- og kølemad, hel- og halvfabrikater)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nye samarbejdsformer i køkkenet (f.eks. team, selvstyrede grupper)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Arbejdsmiljø	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ledelse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Service og kundebetjening	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Andet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[] I hvor høj grad var efteruddannelsen/kurserne brugbare for dig inden for følgende områder? *

Svar kun på dette spørgsmål, hvis følgende betingelse(r) er opfyldt:

Svaret var 'Ja, i op til 1 uge' *eller* 'Ja, i 1 til 2 uger' *eller* 'Ja, i mere end 2 uger' ved spørgsmål '17 [Efteruddannelse]' (Har du det seneste år deltaget i kurser/efteruddannelse i relation til dit arbejde?)

Vælg ét svar for hvert element:

	I meget høj grad	I høj grad	Delvist	I ringe grad	I meget ringe grad
Teori	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Praksis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Økologi

[]Hvad er økologiprocenten i det køkken, hvor du er ansat? *

Vælg én af følgende mulige svar:

- ☐ Ca. 0-29% af maden er økologisk
☐ Ca. 30-59% af maden er økologisk
☐ Ca. 60-89% af maden er økologisk
☐ Ca. 90-100% af maden er økologisk
☐ Ved ikke

[]Hvor enig er du i følgende udsagn? *

Vælg ét svar for hvert element:

	Meget enig	Enig	Delvist enig	Ikke enig	Slet ikke enig	Ved ikke
Maden der bliver produceret i køkkenet er generelt af god kvalitet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg er motiveret for at arbejde med økologisk madproduktion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Jeg oplever generelt at maden bliver modtaget positivt af køkkenets brugere (de spisende)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maden bliver lavet ud fra faste ernæringsmæssige retningslinjer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Maden smages til i køkkenet inden den serveres	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[]Hvilke af følgende er køkkenets primære produktionsmetoder? *

Vælg én eller flere:

- ☐ Varmholdt mad
☐ Kølemad, vakuum-pakning
☐ Frostmad
☐ En blanding
☐ Andet:

[] Hvordan bliver følgende produkter hyppigst tilberedt i køkkenet? *

Vælg ét svar for hvert element:

	Overvejende fra råvare (produceres fra bunden)	Overvejende fra halvfabrikat (herunder pulver, brødblandinger osv.)	Overvejende færdigkøbt (ingen tilberedning)	Serveres ikke af køkkenet	Ved ikke/ikke relevant
Lystbrød og boller	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Rugbrød	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Skrællede/snittede grønsager	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Varme retter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Skiveskåret kødpålæg (f.eks. spege-, rulle- og kødpølse)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Leverpostej	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Andet pålæg (f.eks. tun-, ægge- og skaldyrssalater)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kager og småkager	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Kødudskæringer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[] Har økologiomlægningen i køkkenet inden for det sidste år haft en betydning for dig på følgende områder? *

Vælg ét svar for hvert element:

	Meget positiv	Positiv	Ingen ændring	Negativ	Meget negativ	Ved ikke
Tilfredshed med arbejdet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Glæde ved arbejdet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Belastning ved arbejdet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Motivation for arbejdet	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[] Har du noget at tilføje omkring dit arbejde, undersøgelsen eller spørgsmålene i skemaet, er du meget velkommen til at skrive det i kommentar-feltet herunder.

Skriv dit svar her:

Spørgeskemaet er nu færdigt.

Indsend spørgeskema

Tak for din deltagelse i undersøgelsen.

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